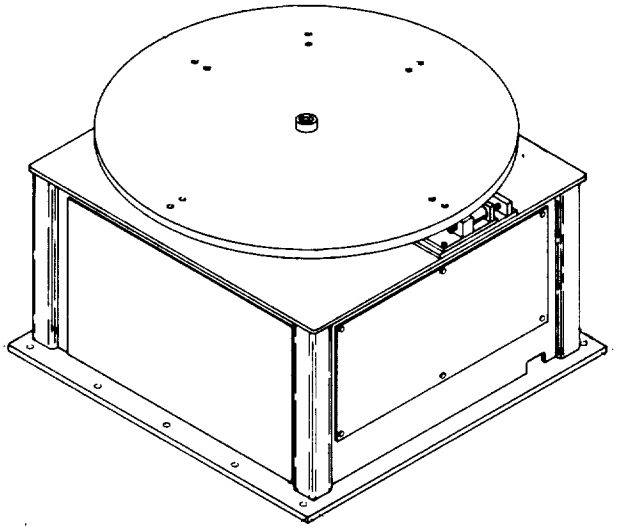
July 1988 FORM: OM-890

Miller®

MODEL: 5 TURNTABLE

IMPORTANT: Illustrations and text in this manual are for the latest Model 5 Turntable. Earlier models may vary slightly. When ordering parts, be sure to identify parts by name, part number and serial number of the machine for which the parts are being ordered.



OWNER'S MANUAL

IMPORTANT: Read and understand the entire contents of this manual, with special emphasis on the safety material throughout the manual, before installing, operating, or maintaining this equipment. This unit and these instructions are for use only by persons trained and experienced in the safe operation of welding equipment. Do not allow untrained persons to install, operate, or maintain this unit. Contact your distributor if you do not fully understand these instructions.

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A Miller Group Ltd. Company

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EFFECTIVE: FEBRUARY 16, 1988

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LIMITED WARRANTY - Subject to the terms and conditions hereof, Miller Electric Mfg. Co., Appleton, Wisconsin warrants to its Distributor/Dealer that all new and unused Equipment furnished by Miller is free from defect in workmanship and material as of the time and place of delivery by Miller. No warranty is made by Miller with respect to engines, trade accessories or other items manufactured by others. Such engines, trade accessories and other items are sold subject to the warranties of their respective manufacturers, if any . All engines are warranted by their manufacturer for one year from date of original purchase, except Tecumseh engines which have a two year warranty.

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3. Original main power rectifiers ..... 3 years (labor - 1 year only)
4. All welding guns, feeder/guns and torches ..... 90 days
5. All other Millermatic Feeders ..... 1 year
6. Replacement or repair parts, exclusive of labor .. 60 days
7. Batteries ..... 6 months

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Mounting Plate Diameter	Optional Fixture Plate Diameter	Load Capacity	Index Speed*	Indexing Repeatability	Weight	
					Net	Ship
48 in. (1219 mm)	60 in. (1524 mm)	1000 lbs. (454 kg)	5 Seconds For 180° Rotation Either Clockwise Or Counterclockwise At Load Capacity	0.005 in. (0.13 mm)	2000 lbs. (907 kg)	2000 lbs. (907 kg)

*Speed increases when operating with less weight.

Figure 1 - 1. Turntable Specifications

Input Power Single-Phase AC	Reservoir Capacity	Hydraulic Fluid	Pump Flow Rate	System Relief Pressure	Range Of System Operating Pressure
115 Volts, 60 Hz	Maximum: 8 qt. (7.6 l) Fill Quantity: 6 qt. (5.7 l)	ISO 32 Antiwear Hydraulic Oil	0.5 gpm (1.9 l/min)	1500 psi (10342 kPa)	950 psi to 1250 psi (6550 kPa to 8618 kPa)

Figure 1 - 2. Hydraulic System Specifications

	Dimensions	
	Inches	Millimeters
A	32-1/4	819.2
B	48	1219.2
C	46	1168.4
D	35	889
E	24	609.6
F	13	330.2
G	2	50.8
H	1	25.4
I	47	1193.8
J	48	1219.2

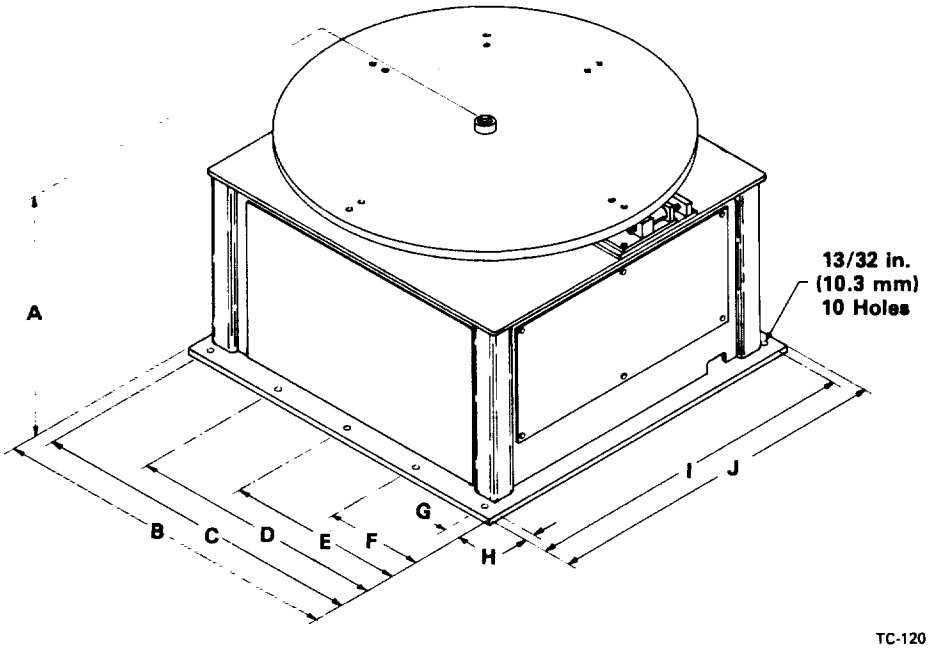


Figure 1 - 3. Overall Dimensions And Base Mounting Hole Layout

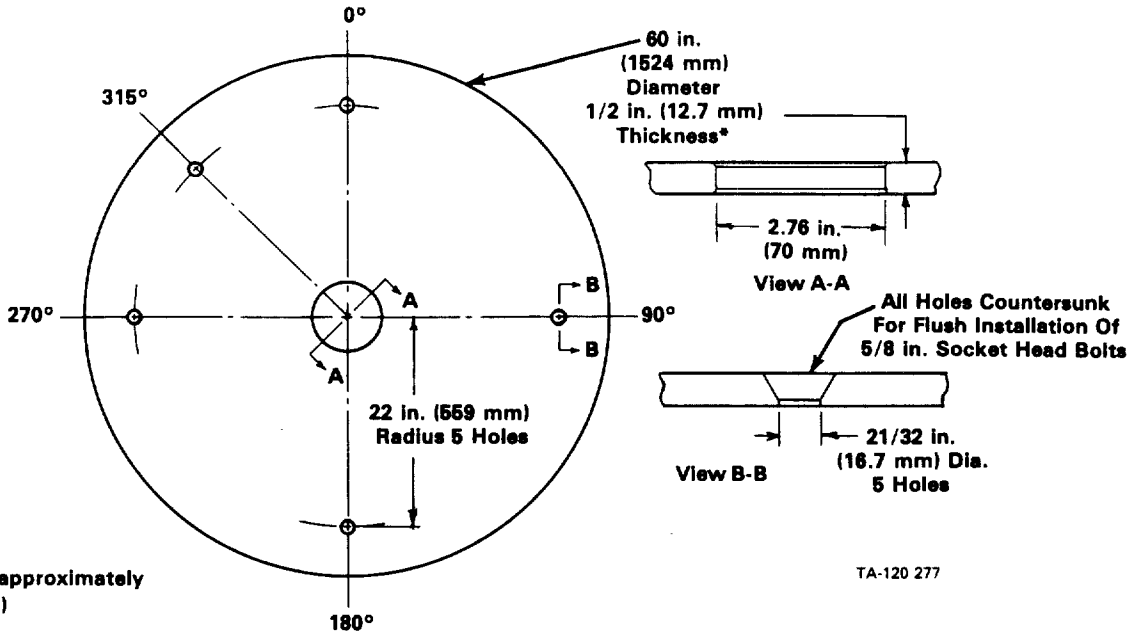


Figure 1 - 4. Dimensions And Hole Layout Of Optional Fixture Plate

1 - 1. GENERAL INFORMATION AND SAFETY

A. General

Information presented in this manual and on various labels, tags, and plates on the unit pertains to equipment design, installation, operation, maintenance, and troubleshooting which should be read, understood, and followed for the safe and effective use of this equipment.

B. Safety

The installation, operation, maintenance, and troubleshooting of arc welding equipment requires practices and procedures which ensure personal safety and the safety of others. Therefore, this equipment is to be installed, operated, and maintained only by qualified persons in accordance with this manual and all applicable codes and safety rules such as, but not limited to, those listed in Section 1 - Safety of the robot Owner's Manual and in Section 1 - Safety Rules For Operation of Arc Welding Power Source in the welding power source Owner's Manual.

Safety instructions specifically pertaining to this unit appear throughout this manual highlighted by the signal words **WARNING** and **CAUTION** which identify different levels of hazard.

WARNING statements include installation, operation, and maintenance procedures or practices which if not carefully followed could result in serious personal injury or loss of life.

CAUTION statements include installation, operation, and maintenance procedures or practices which if not carefully followed could result in minor personal injury or damage to this equipment.

A third signal word, **IMPORTANT**, highlights instructions which need special emphasis to obtain the most efficient operation of this equipment.

1 - 2. RECEIVING-HANDLING - Before installing this equipment, clean all packing material from around the unit and carefully inspect for any damage that may have occurred during shipment. Any claim for loss or damage that may have occurred in transit must be filed **by the purchaser with the carrier.** A copy of the bill of lading will be furnished by the manufacturer on request if occasion to file claim arises.

When requesting information concerning this equipment, it is essential that Model Description and Serial Number of the equipment be supplied.

1 - 3. DESCRIPTION - The Model 5 Turntable is a circular mounting plate and hydraulic drive system that provides smooth, accurate rotation for deliverying parts into a work envelope of an automated welding system. The mounting plate operates in alternating clockwise and counterclockwise rotations of 180 degrees. Indexing speed for a complete rotation at the 1000 pounds (454 kg) load capacity is 5 seconds which includes locking the mounting plate in position. Control of the mounting plate rotation and locking pin movement is provided by input/output signals through lead connections from the Model 5 Turntable to the I/O ports on a programmable control unit.

A 60 in. (1524 mm) diameter optional fixture plate is available for mounting weld fixtures and increasing the working surface area. Additional fixture plates can be used as fixturing requirements increase to provide fast changeover of weld fixtures by only exchanging fixture plates on the turntable.

All turntable control components are adjusted as part of the original installation. If changes are made by the user that affects load weight on the mounting plate, adjustments may then be required.

IMPORTANT: *The Model 88 Gantry and Model 134 Gantry come with the Model 5 Turntable installed and connected for operation. If the turntable is to be used without a robot control, contact factory Technical Sales department.*

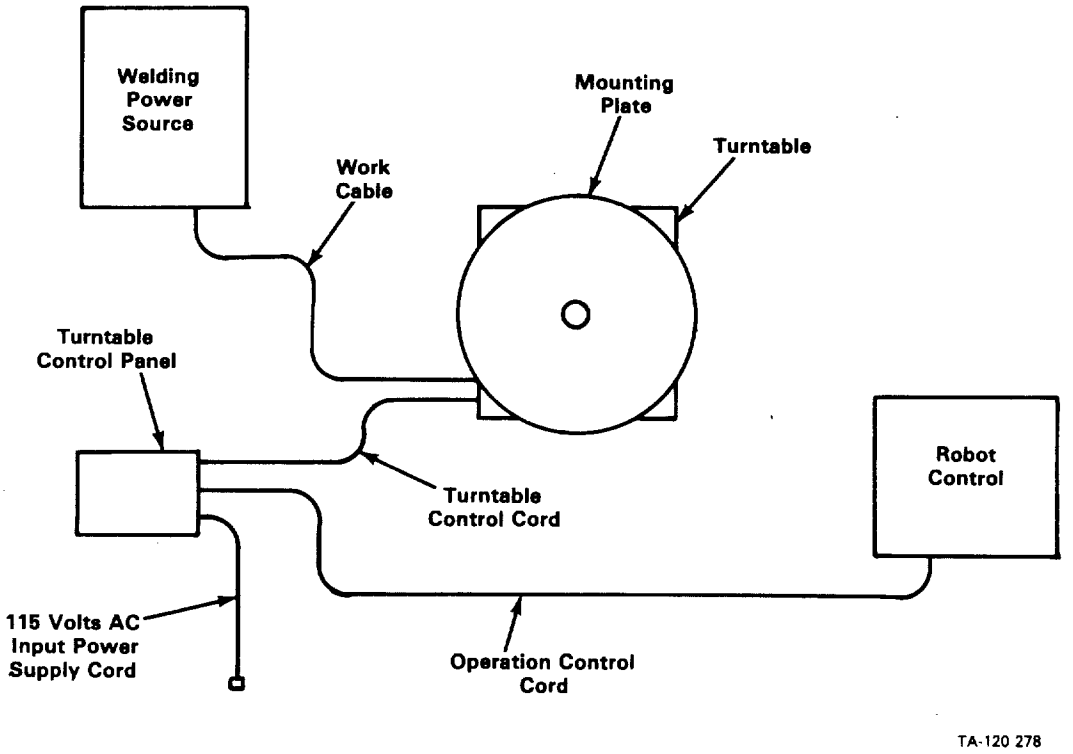


Figure 2 - 1. Connection Diagram For Turntable And MR-5 Robot Control

2 - 1. WORK CABLE CONNECTIONS (Figure 2-2)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before making or checking work cable connection or contact pad assembly.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of moving parts.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

The welding power source work cable connects to a contact pad assembly mounting rod located above the spindle pulley inside the turntable chassis. Spring tension holds the contact pad against the spindle retainer bushing to provide continuity between the work cable connection and the mounting plate.

Be sure that work cable is routed away from moving parts and lug connection is tight. Check for adequate spring tension at mounting rods to properly align contact pad against spindle retainer bushing, but do not overtighten springs as this will cause premature wear of the contact pad.

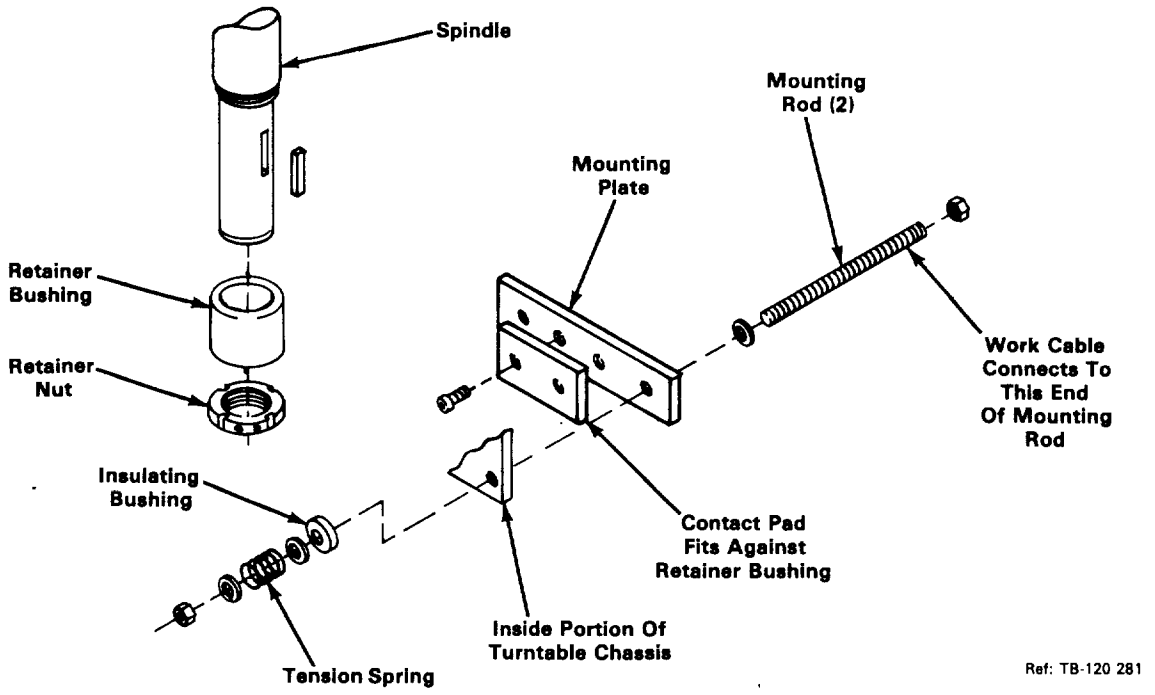


Figure 2 - 2. Contact Pad Assembly For Work Cable Connection

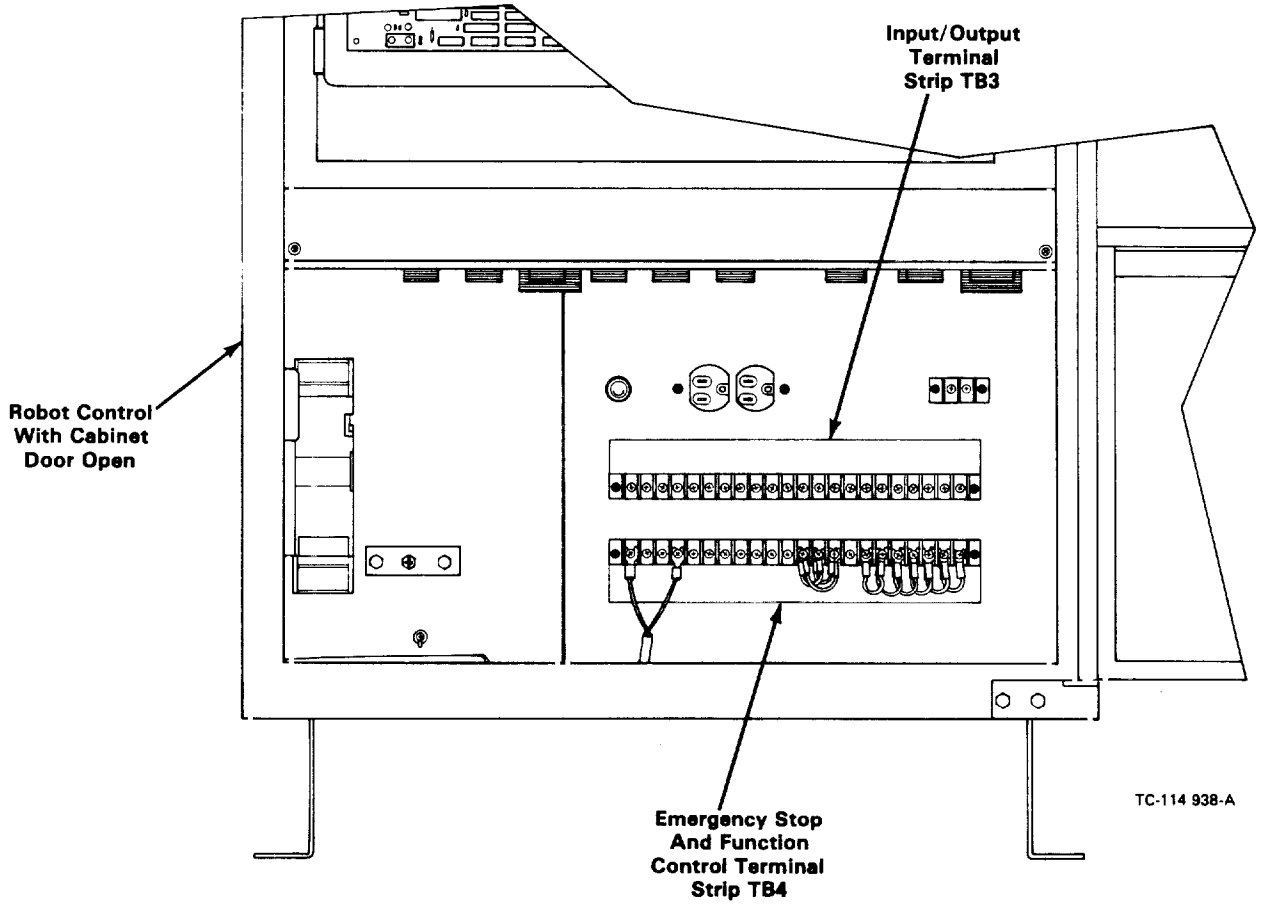

Input/Output Terminal Strip TB3
Robot Control With Cabinet Door Open
TC-114 938-A
Emergency Stop And Function Control Terminal Strip TB4

Figure 2 - 3. Location Of Terminal Strips TB3 And TB4 Inside MR-5 Robot Control

2 - 2. OPERATION CONTROL CORD CONNECTIONS

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before making or checking operation control cord connections.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

ELECTROSTATIC DISCHARGE (ESD) can damage circuit board components.

- *Put on properly grounded wrist strap BEFORE handling circuit boards.*
- *Transport all static-sensitive components in proper static-shielding carriers or packages.*
- *Perform work only at a static-safe work area.*

Control of turntable operation for mounting plate rotation, locking pin movement, and the Emergency Stop function is provided by lead connections from the turntable control panel to Input/Output and Emergency Stop terminals inside the MR-5 Robot Control. The location of the Robot Control terminal strips and terminal designations are shown in Figures 2-3 and 2-4.

Be sure that all lead connections are correct and secure to terminals on appropriate Robot Control terminal strips (refer to circuit diagram Figure 4-25 for identification of leads and connection points).

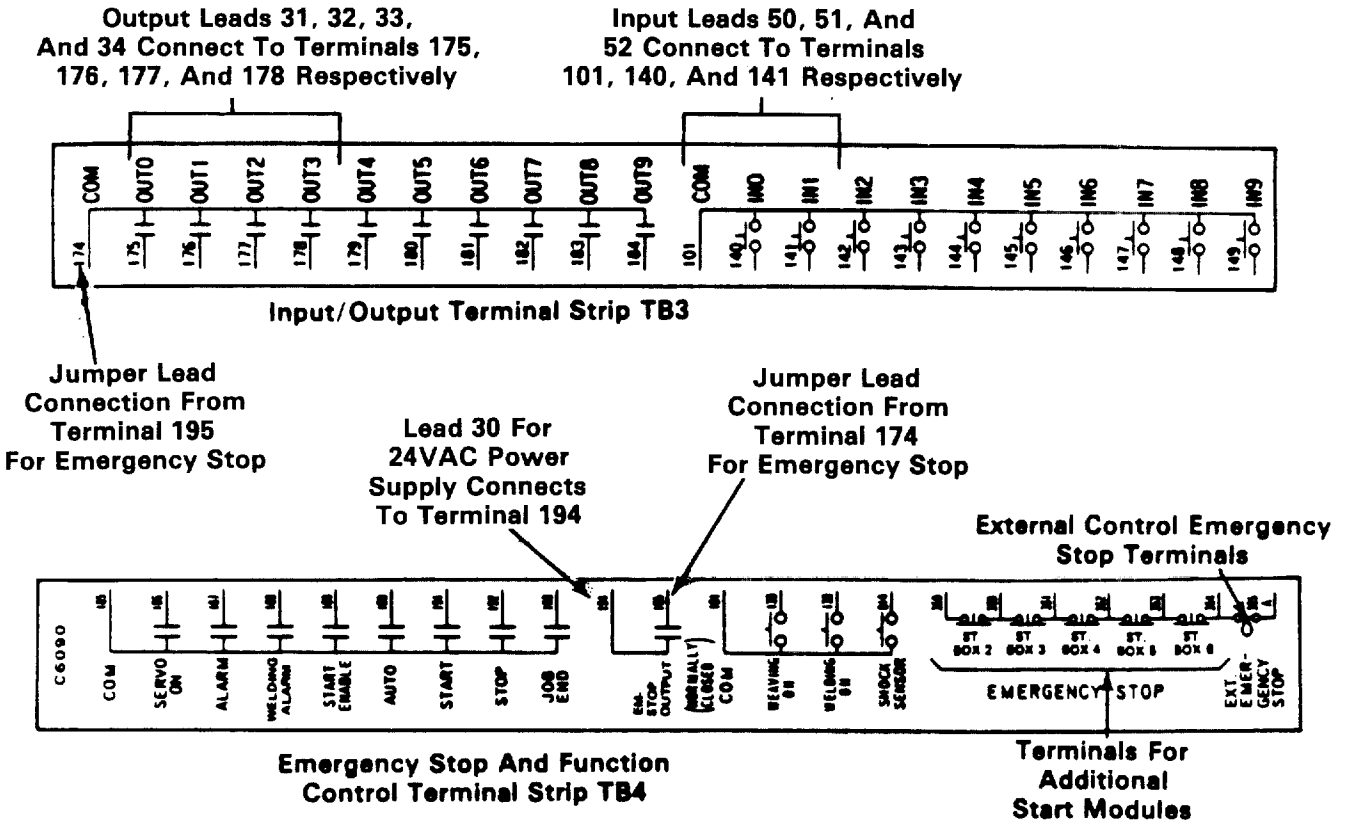


Figure 2 - 4. Operation Control Cord Lead Connections To Terminal Strips TB3 And TB4 Inside MR-5 Robot Control

SECTION 3 - OPERATION

For the robot system to perform operations in the proper sequence, it will be necessary to write and enter programs and jobs that coordinate turntable functions with weld programs.

This Section provides program and job examples that control turntable operation, combine the turntable operation with weld programs, and links the individual programs together into a job for total robotic system operation.

IMPORTANT: *The program and job data sequences or steps shown in the examples can be used for actual programs or jobs; however, some modification may be necessary to provide different functions for specific system applications (see Section 5 - Teaching in the robot Owner's Manual for additional data information).*

3 - 1. PROGRAM EXAMPLE FOR TURNTABLE MOUNTING PLATE ROTATION - To provide proper turntable operation, it is necessary to write and enter a program that controls the mounting plate rotation. Since a full rotation of the mounting plate is 180 degrees either clockwise or counterclockwise, only half of the mounting plate surface will be located in the work envelope. By dividing the mounting plate surface into halves, and assigning a numerical side designation to each half, signals from the turntable allow checking for appropriate side location within the work envelope. Input ports 000 and 001, located on the I/O terminal strip inside the Robot Control, match the numerical side designations. The edge of the mounting plate is stamped with the numerical designations to identify the two sides.

IMPORTANT: *If the sequence data in example program 999 is used for an actual program, check turntable operation for the program sequences in BLOCK FORWARD CONTINUOUS mode before beginning welding operations. Mounting plate load weight may require adjusting the time-delay relay setting (see Section 3-5).*

PROGRAM NUMBER 999		
Sequence No.	**Sequence Data**	**Sequence Operation**
001	P	Position (home) move by manipulator to a location which does not interfere with jigs, fixtures, or weldments on mounting plate of turntable.
002	JN0 000	Jump to destination PM0 if side 000 is in work envelope. Jump is performed if signal is present at Robot Control input port 000.
003	P	Position (home) move by manipulator (see Sequence Number 001).
004	R000	Turn off signal at Robot Control output port 000 that activates locking pin movement in the up direction.
005	T00.5	Robot Control timer set for 0.5 seconds to deenergize directional control valve solenoid.
006	S001	Turn on signal at Robot Control output port 001 that activates locking pin movement in the down direction.
007	T01.0	Robot Control timer set for 1.0 second to allow time for locking pin movement.
008	S002	Turn on signal at Robot Control output port 002 that activates mounting plate rotation in the clockwise direction and energize time-delay relay (see Section 3-5).
009	R001	Turn off signal at Robot Control output port 001 that activates locking pin movement in the down direction.
010	N000 WDT ∞ (infinite)	Check for signal at Robot Control input port 000 which indicates side 000 is in the work envelope.
011	T01.0	Robot Control timer set for 1.0 second to allow mounting plate position to stabilize at end of rotation.
012	S000	Turn on signal at Robot Control output port 000 that activates locking pin movement in the up direction.
013	R002	Turn off signal at Robot Control output port 002 that activates mounting plate rotation in the clockwise direction and reset time-delay relay.
014	P	Position (home) move by manipulator (see Sequence Number 001).
015	JP2	Unconditional jump to destination PM2 after mounting plate rotation to side 000.
016	P	Position (home) move by manipulator (see Sequence Number 001).
017	PM0	Destination point 0 for jump sequence JN0 000 (see Sequence Number 002).
018	P	Position (home) move by manipulator (see Sequence Number 001).
019	R000	Turn off signal at Robot Control output port 000 that activates locking pin movement in the up direction.

PROGRAM NUMBER 999		
Sequence No.	**Sequence Data**	**Sequence Operation**
020	T00.5	Robot Control timer set for 0.5 seconds to deenergize directional control valve solenoid.
021	S001	Turn on signal at Robot Control output port 001 that activates locking pin movement in the down direction.
022	T01.0	Robot Control timer set for 1.0 second to allow time for locking pin movement.
023	S003	Turn on signal at Robot Control output port 003 that activates mounting plate rotation in the counterclockwise direction and energize time-delay relay (see Section 3-5).
024	R001	Turn off signal at Robot Control output port 001 that activates locking pin movement in the down direction.
025	N001 WDT ∞ (infinite)	Check for signal at Robot Control input port 001 which indicates side 001 is in work envelope.
026	T01.0	Robot control timer set for 1.0 second to allow mounting plate position to stabilize at end of rotation.
027	S000	Turn on signal at Robot Control output port 000 that activates locking pin movement in the up direction.
028	R003	Turn off signal at Robot Control output port 003 that activates mounting plate rotation in the counterclockwise direction and reset time-delay relay.
029	PM2	Destination point 2 for jump sequence JP2 (see Sequence Number 015).
030	P	Position (home) move by manipulator (see Sequence Number 001).
031	END	End of Program Number 999.

OUTPUTS

000: Pin Up
001: Pin Down
002: CW Rotation
003: CCW Rotation

INPUTS

000: CW Arrival
001: CCW Arrival

3 - 2. PROGRAM EXAMPLE FOR SIDE 001 WELDING OPERATION - Sequence data that matches side 001 in the work envelope with the appropriate welding operations is necessary in the weld program. Data in example Program 111 provides the necessary check for the location of side 001 before beginning any weld sequence.

PROGRAM NUMBER 111 (SIDE 001)		
Sequence No.	**Sequence Data**	**Sequence Operation**
001	P	Position (home) move by manipulator to a location which does not interfere with jigs, fixtures, or weldments on mounting plate of turntable.
002	JN4 000	Jump to destination 4 if side 000 is in the work envelope. Jump is performed if signal is present at Robot Control input port 000.
003 ↓ 050	↓	Enter sequence data for welding operation. Total number of sequences and specific data will depend on the desired operation.
051	PM4	Destination point 4 for jump sequence (see Sequence Number 002).
052	P	Position (home) move by manipulator (see Sequence Number 001).

PROGRAM NUMBER 111 (SIDE 001)		
Sequence No.	**Sequence Data**	**Sequence Operation**
053	END	End of Program Number 111.

3 - 3. PROGRAM EXAMPLE FOR SIDE 000 WELDING OPERATION - Sequence data that matches side 000 in the work envelope with the appropriate welding operations is necessary in the weld program. Data in example Program 222 provides the necessary check for location of side 000 before beginning any weld sequence.

PROGRAM NUMBER 222 (SIDE 000)		
Sequence No.	**Sequence Data**	**Sequence Operation**
001	P	Position (home) move by manipulator to a location which does not interfere with jigs, fixtures, or weldments on mounting plate of turntable.
002	JN4 001	Jump to destination 4 if side 001 is in the work envelope. Jump is performed if signal is present at Robot Control input port 001.
003 ↓ 050	↓	Enter sequence data for welding operation. Total number of sequences and specific data will depend on the desired operation.
051	PM4	Destination point 4 for jump sequence (see Sequence Number 002).
052	P	Position (home) move by manipulator (see Sequence Number 001).
053	END	End of Program Number 222.

3 - 4. JOB EXAMPLE FOR LINKING PROGRAMS

IMPORTANT: *When linking weld programs together in a job for the turntable application, ALWAYS enter the program number to rotate mounting plate ONLY once in the job on line number 1.*

JOB NO.	LINE NO.	LINE DATA	LINE OPERATION
J777	1:	P999	Run Program 999 to rotate mounting plate on turntable.
	2:	P111	Run Program 111 if side 001 of mounting plate is in the work envelope.
	3:	P222	Run Program 222 if side 000 of mounting plate is in the work envelope.
	4:	END	End of Job 777.

Example Job 100 is a linking method using job level logic for individual parts in the turntable application that combines the weld programs for each part with example Program 999 for mounting plate rotation. The job logic in this example only runs the weld programs for matching parts located at the weld side of the turntable.

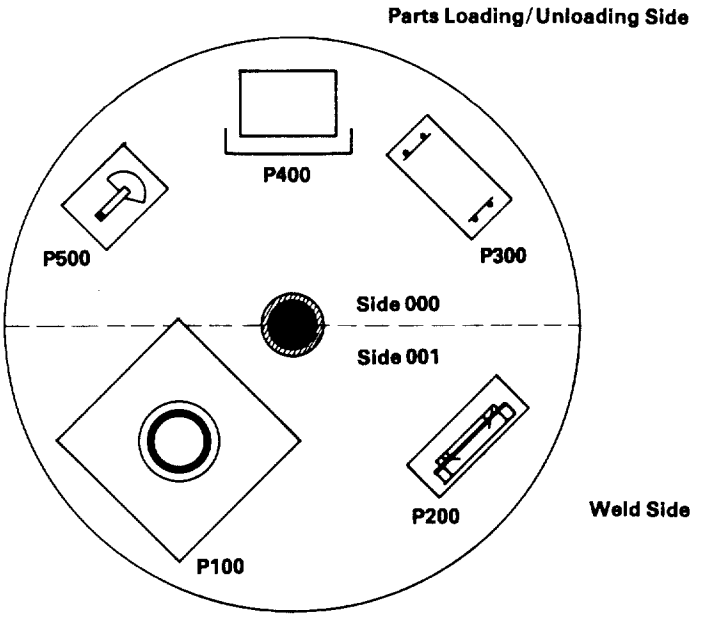


Figure 3 - 1. Example Job 100 Starting Position Of Turntable Parts Layout And Matching Program Numbers

JOB NO.	LINE NO.	LINE DATA	LINE OPERATION
J100	1:	P999	Run Program 999 to rotate mounting plate on turntable.
	2:	CN000 P300	Call and run Program 300 if side 000 is at weld side of turntable.
	3:	CN000 P400	Call and run Program 400 if side 000 is at weld side of turntable.
	4:	CN000 P500	Call and run Program 500 if side 000 is at weld side of turntable.
	5:	CN001 P100	Call and run Program 100 if side 001 is at weld side of turntable.
	6:	CN001 P200	Call and run Program 200 if side 001 is at weld side of turntable.
	7:	END	End of Job 100.

Prior to selecting Automatic mode for running Job 100, parts for weld Programs 300, 400, and 500 are loaded in side 000 fixtures.

Running Job 100 the first time in Automatic mode will perform the line data as follows:

Line 1: Program 999 runs and rotates mounting plate on turntable. Parts on side 000 for weld Programs 300, 400, and 500 are now located at weld side of turntable (see Figure 3-2).

Line 2: Control unit of manipulator checks for an input signal at port 000. Turntable proximity switch for side 000 is on and supplies input signal to port 000 indicating side 000 is at weld side of turntable. Control unit calls and runs Program 300.

Line 3: Proximity switch for side 000 supplies input signal to control unit port 000. Control unit calls and runs Program 400.

Line 4: Proximity switch for side 000 supplies input signal to control unit port 000. Control unit calls and runs Program 500.

Line 5: Control unit of manipulator checks for an input signal at port 001. Turntable proximity switch for side 001 is off and no input signal is present at control unit input port 001 indicating side 001 is not at weld side of turntable. Control unit does not run Program 100.

Line 6: No input signal is present at control unit input port 001. Control unit does not run Program 200.

Line 7: End first run of Job 100.

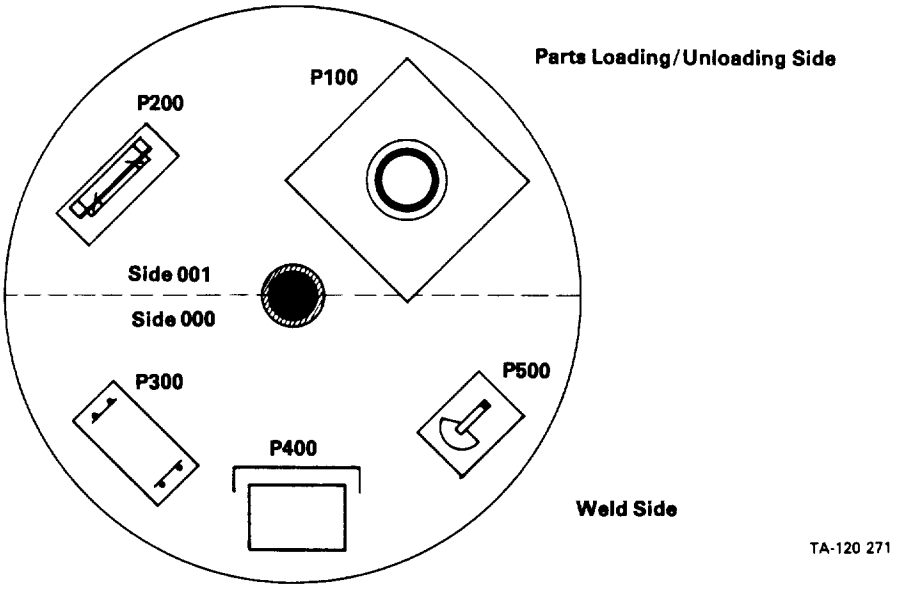


Figure 3 - 2. Position Of Turntable Parts Layout During First Run Of Job 100

While Job 100 runs the first time in Automatic mode and manipulator performs welding operations for Programs 300, 400, and 500, parts for weld Programs 100 and 200 are loaded in side 001 fixtures at parts loading/unloading side of turntable. Running Job 100 the second time in Automatic mode will perform the line data as follows:

Line 1: Program 999 runs and rotates mounting plate on turntable. Parts on side 001 for weld Programs 100 and 200 are now locate at weld side of turntable (see Figure 3-3).

Line 2: Control unit of manipulator checks for an input signal at port 000. Turntable proximity switch for side 000 is off and no input signal is present at control unit input port 000 indicating side 000 is not at weld side of turntable. Control unit does not run Program 300.

Line 3: No input signal is present at control unit input port 000. Control unit does not run Program 400.

Line 4: No input signal is present at control unit input port 000. Control unit does not run Program 500.

Line 5: Control unit of manipulator checks for an input signal at port 001. Turntable proximity switch for side 001 is on and supplies input signal to port 001 indicating side 001 is at weld side of turntable. Control unit calls and runs Program 100.

Line 6: Proximity switch for side 001 supplies input signal to control unit and input port 001. Control unit calls and runs Program 200.

Line 7: End second run of Job 100.

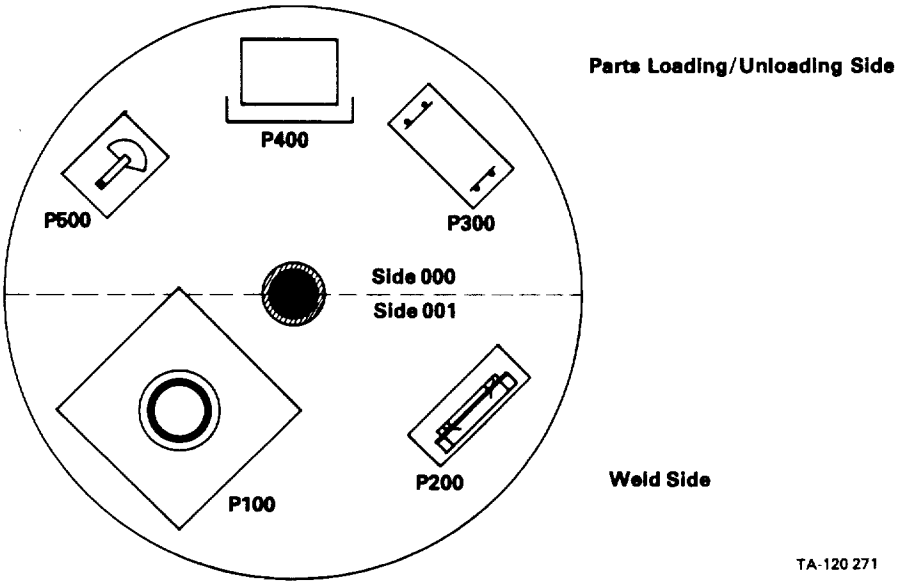


Figure 3 - 3. Position Of Turntable Parts Layout During Second Run Of Job 100

While Job 100 runs the second time in Automatic mode and manipulator performs welding operations for Programs 100 and 200, finished parts for Programs 300, 400, and 500 from first run of Job 100 are unloaded and new parts are loaded in side 000 fixtures.

Each additional run of Job 100 rotates mounting plate and runs weld programs that match parts located at weld side of turntable while finished parts are unloaded and new parts loaded in fixtures at parts loading/unloading side.

3 - 5. SETTING RELAY TIME FOR HIGH-SPEED VALVE (Figure 3-4)

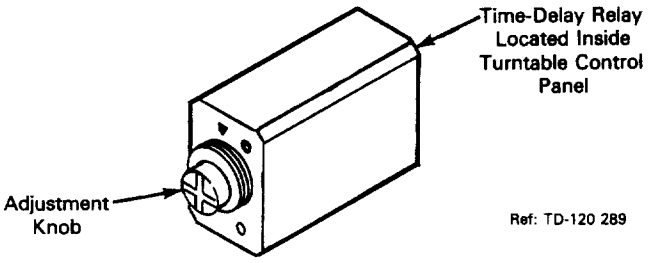


Figure 3 - 4. Adjustable Time-Delay Relay

An adjustable time-delay relay, located inside the turntable control panel, provides a time range of 0.1 to 1.0 second in 0.05 second increments for energizing the high-speed valve. The relay contacts are closed at the beginning of each mounting plate rotation which opens the high-speed valve to increase mounting plate rotating speed. The contacts open when the relay times out which closes the high speed valve and the low-speed rotation control decreases mounting plate final rotating speed.

To adjust relay time, proceed as follows:

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before setting relay time.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

1. Open hinged front cover on control panel.

IMPORTANT: *Setting relay time depends on the amount of mounting plate load weight. The chart in Figure 3-5 is a guide for setting an appropriate relay time for a given load weight. A specific setting for relay time to provide the most efficient operation may vary from the chart due to location and distribution of weight on the mounting plate.*

2. Locate time-delay relay in upper left corner inside control panel, and rotate adjustment knob to desired time selection.

3. Close and secure front cover.

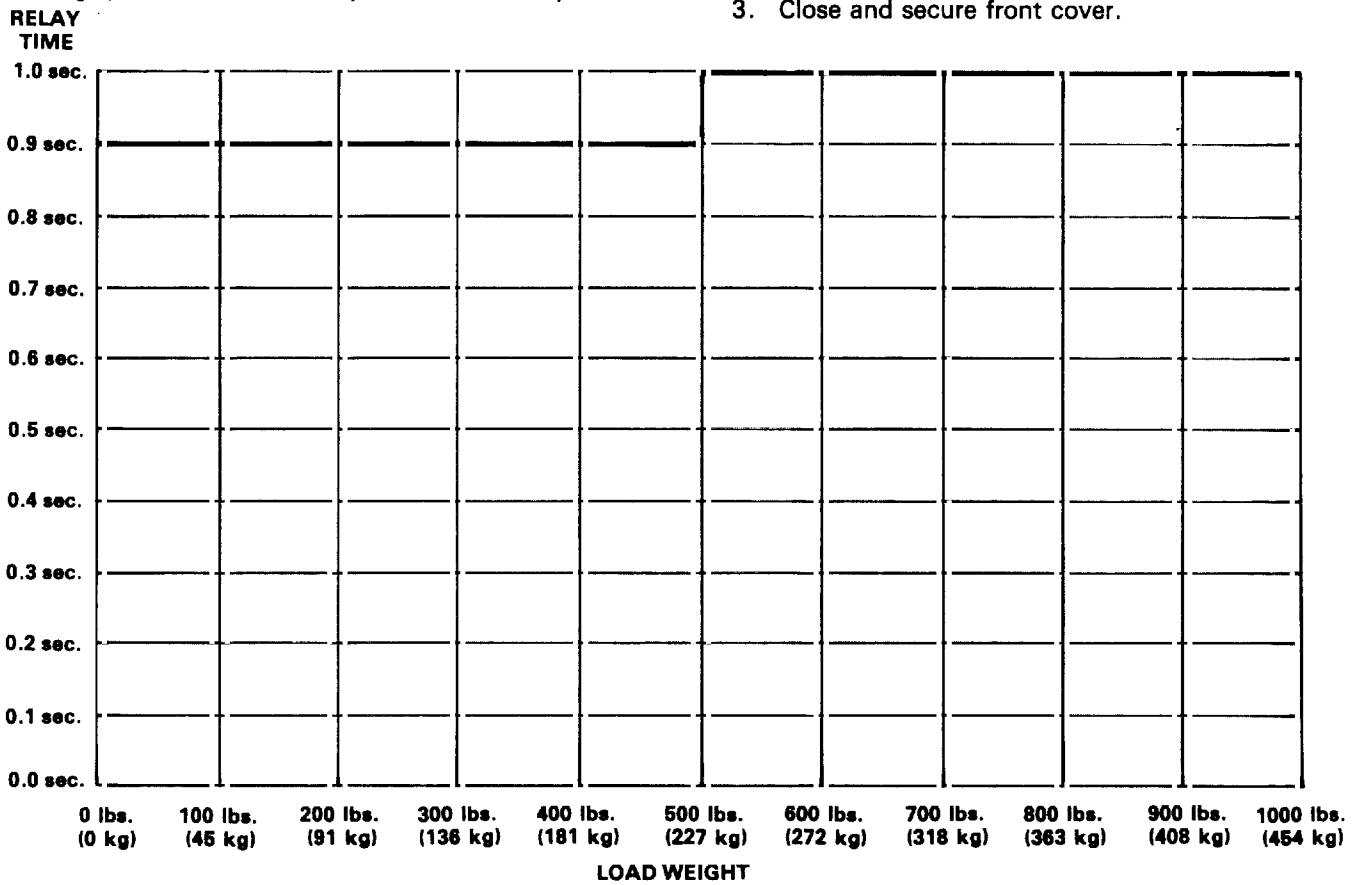


Figure 3 - 5. Load Weight And Relay Time Chart

IMPORTANT: *All directions, such as left or right, are with respect to the operator facing the turntable (front) on the weld side of work envelope and with locking pin assembly located at opposite side (rear).*

4 - 1. CLEANING AND INSPECTION

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of moving parts.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

Maintenance to be performed only by qualified persons.

A schedule for cleaning and inspection should be set up, based on the type and conditions of service, to include the following:

Keep the inside of the unit clean by blowing out the unit with clean, dry compressed air.

Wipe oil spills from base and support surface immediately to avoid accumulation of dust.

Check for oil leaks indicating loose hydraulic connections inside the turntable. Tighten loose connections and wipe oil from surfaces.

Check all hoses, cords, and cables for cracks or frayed areas. Replace any damaged hydraulic hoses and repair or replace faulty cords or cables.

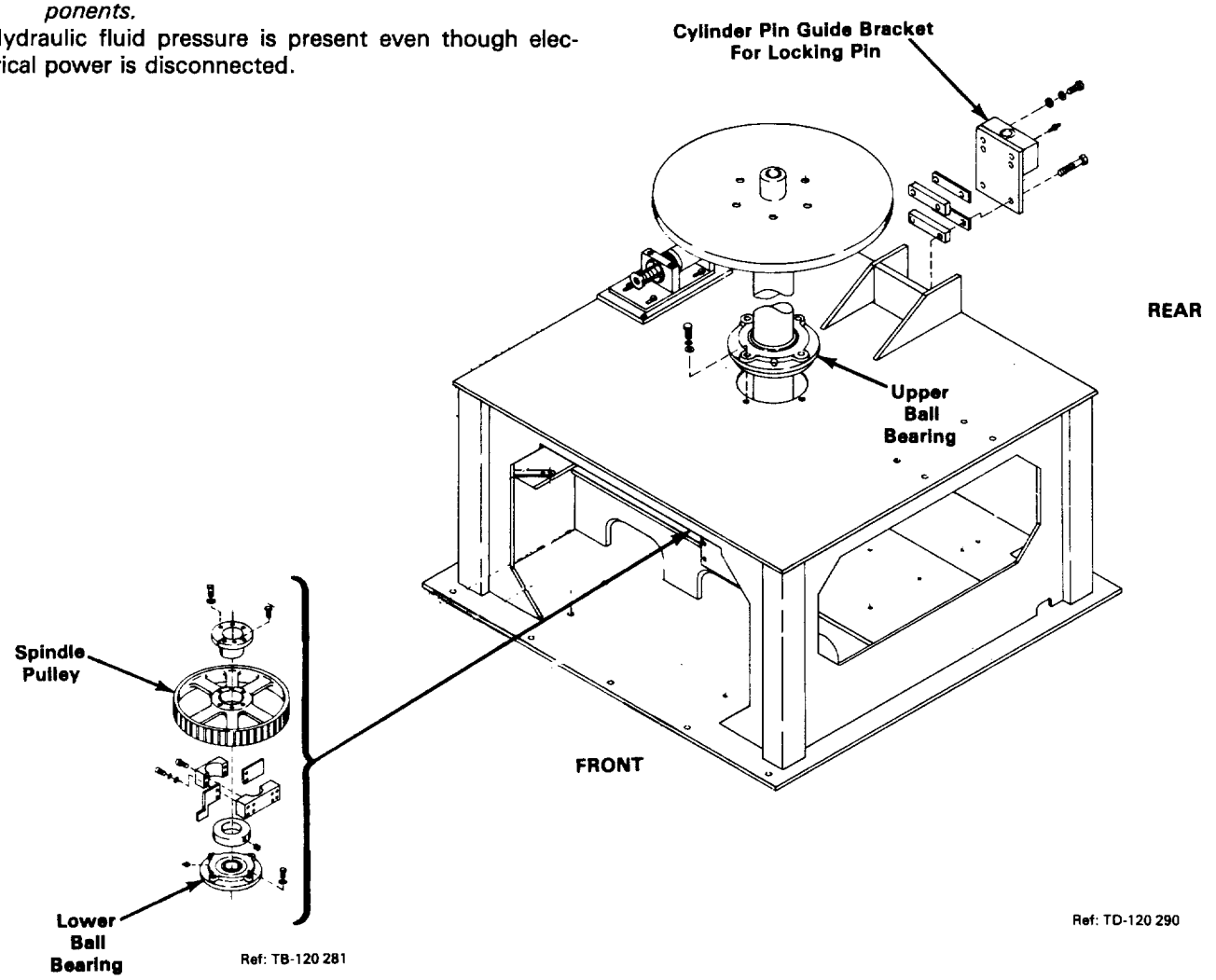


Figure 4 - 1. Location Of Cylinder Pin Guide Bracket And Ball Bearings

4 - 2. LUBRICATION (Figure 4-1)

A. Lubricating Ball Bearings

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause injury.

- *Do not touch live electrical parts.*
- *Keep clear of pinch points.*

Turntable operation is required to properly lubricate ball bearings.

Every month lubricate the upper and lower ball bearings that support the spindle on the turntable. If dusty, moist, or corrosive environmental conditions are present, more frequent lubrication may be necessary.

Remove rear cover from turntable chassis to gain access to lower bearing lube fitting.

IMPORTANT: *Use a lithium-base grease for lubrication. While adding grease to the bearings, rotate spindle to evenly distribute grease. Sufficient lubrication is added to bearings when a slight leakage of grease is present at the seals. Wipe off any excess grease from around lube fittings and bearings.*

B. Lubricating Locking Pin

Every month lubricate the locking pin that secures the mounting plate after each rotation. If dusty, moist, or corrosive environmental conditions are present, more frequent lubrication may be necessary.

Lube fitting is located below mounting plate in the cylinder pin guide bracket.

IMPORTANT: *Use a lithium-base grease for lubrication. Sufficient lubrication is added when a slight leakage of grease is present at the seals. Wipe off any excess grease from around lube fitting and cylinder pin guide bracket.*

4 - 3. OIL FILTER (Figure 4-2)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before servicing or inspecting.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

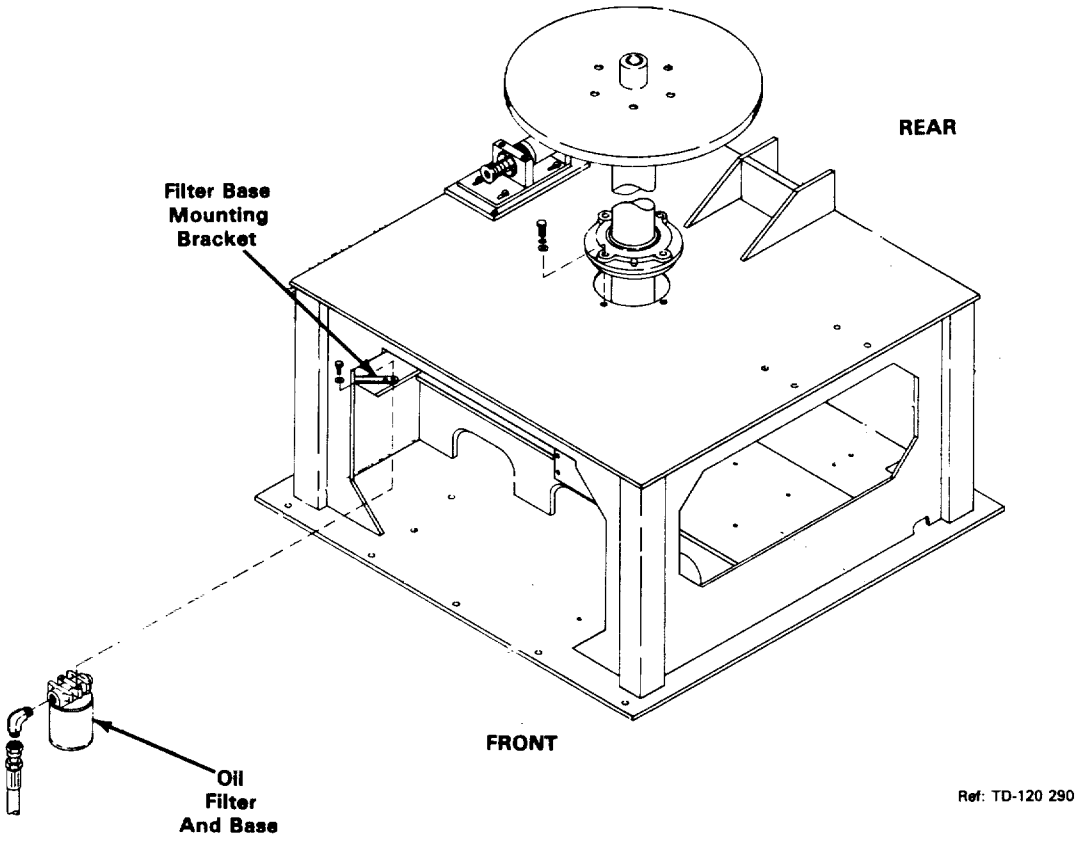


Figure 4 - 2. Location Of Oil Filter

The turntable is equipped with a spin-on type oil filter in the return line of the hydraulic system. Replace the filter after every 350 hours of turntable operation as follows:

IMPORTANT: *A guide for replacement filters is provided in Table 4-1.*

1. Remove front and rear covers from turntable chassis.
2. Press the push button on top of the motor/pump adapter to release pressurized fluid from accumulator, and check for a zero (0) reading at pressure switch gauge.
3. Remove filter from base assembly.
4. Lubricate gasket on replacement filter with hydraulic oil, and install filter securely onto base assembly. After seal contacts base, tighten filter one more turn.

Table 4 - 1. Interchangable Replacement Oil Filters

Filter Manufacturer Or Brand Name	Series Or Type
CANFLO	CFRS-30
CROSS	F 1
FRAM	1653 F
GRESSEN	F 100
LENZ	CP 750
MICHIGAN	S-28
RAND *	FS 15
RIPLEY	DP-752
UCC	US 1500

*Original equipment oil filter.

IMPORTANT: *Before beginning regular turntable operation after replacing the filter, manually run the program for rotating the mounting plate using the BLOCK FORWARD CONTINUOUS mode, and inspect filter and base assembly for fluid leaks. Check the reservoir fluid level, and add oil if necessary (see Section 4-4).*

5. Reinstall covers onto turntable chassis.

4 - 4. CHECKING RESERVOIR FLUID LEVEL (Figure 4-3)

IMPORTANT: *The initial break-in time for the hydraulic system is 2 days of turntable operation which allows the fluid level in the reservoir to stabilize. After operating the turntable for 2 days, check reservoir fluid level according to this procedure.*

The turntable is shipped with the proper amount of fluid in the hydraulic reservoir. A sight gauge, located on the end of the reservoir, is provided for ease of visually checking the fluid level. After the initial 2 days of operation, and again after every 350 hours of operation, check reservoir fluid level as follows:

WARNING: ELECTRIC SHOCK can kill.
- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.
- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.
- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

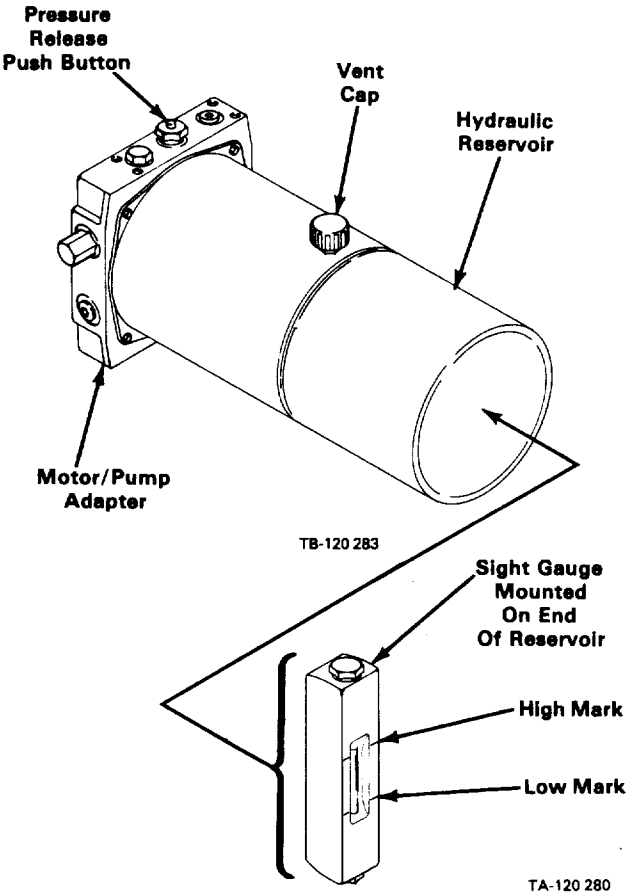


Figure 4 - 3. Location Of Sight Gauge

1. Remove front, rear, and left side covers from turntable chassis.

IMPORTANT: *Check reservoir fluid level only when hydraulic system is at zero (0) pressure. Any pressurized fluid stored in the accumulator must first be released before fluid level in reservoir can be checked accurately.*

2. Press the push button on top of the motor/pump adapter to release pressurized fluid from accumulator, and check for a zero (0) reading at pressure switch gauge.

3. Visually check sight gauge to verify that fluid level is 1/2 to 3/4 above the LOW mark. If fluid level is less than halfway between HIGH and LOW marks, add hydraulic oil to reservoir as follows:

   a. Remove vent cap from reservoir.

IMPORTANT: *Add only ISO 32 antiwear hydraulic oil to reservoir, always use clean equipment to prevent fluid contamination, and do not overfill reservoir when adding hydraulic oil.*

   b. Add the necessary quantity of hydraulic oil to reservoir to raise fluid level in sight gauge to halfway between HIGH and LOW marks.

   c. Reinstall vent cap on reservoir.

4. Reinstall covers onto turntable chassis.

4 - 5. ADJUSTMENT OF LOW-SPEED ROTATION CONTROL (Figure 4-4) - The adjustable low-speed rotation control reduces mounting plate speed during rotation after the high-speed valve deenergizes. The low-speed rotation control, located in the return line between the filter and directional control valves, is equipped with an adjustment knob to allow increasing or decreasing the exhaust flow of hydraulic oil to the reservoir (meter-out flow control).

Adjustment of the low-speed rotation control and time set on the time-delay relay to keep the high-speed valve open must be coordinated together to accommodate the amount of weight placed on the turntable mounting plate.

IMPORTANT: *When weight on the mounting plate decreases, adjust setting of time-delay relay according to Section 3-5, and rotate adjustment knob on low-speed rotation control slightly clockwise from previous setting to decrease exhaust flow of hydraulic oil. When weight on the mounting plate increases, adjust setting of time-delay relay according to Section 3-5, and rotate adjustment knob on low-speed rotation control slightly counterclockwise from previous setting to increase exhaust flow of hydraulic oil, Low-speed rotation control adjustment can change locking pin speed. Be sure to check and adjust locking pin speed as necessary (see Section 4-6).*

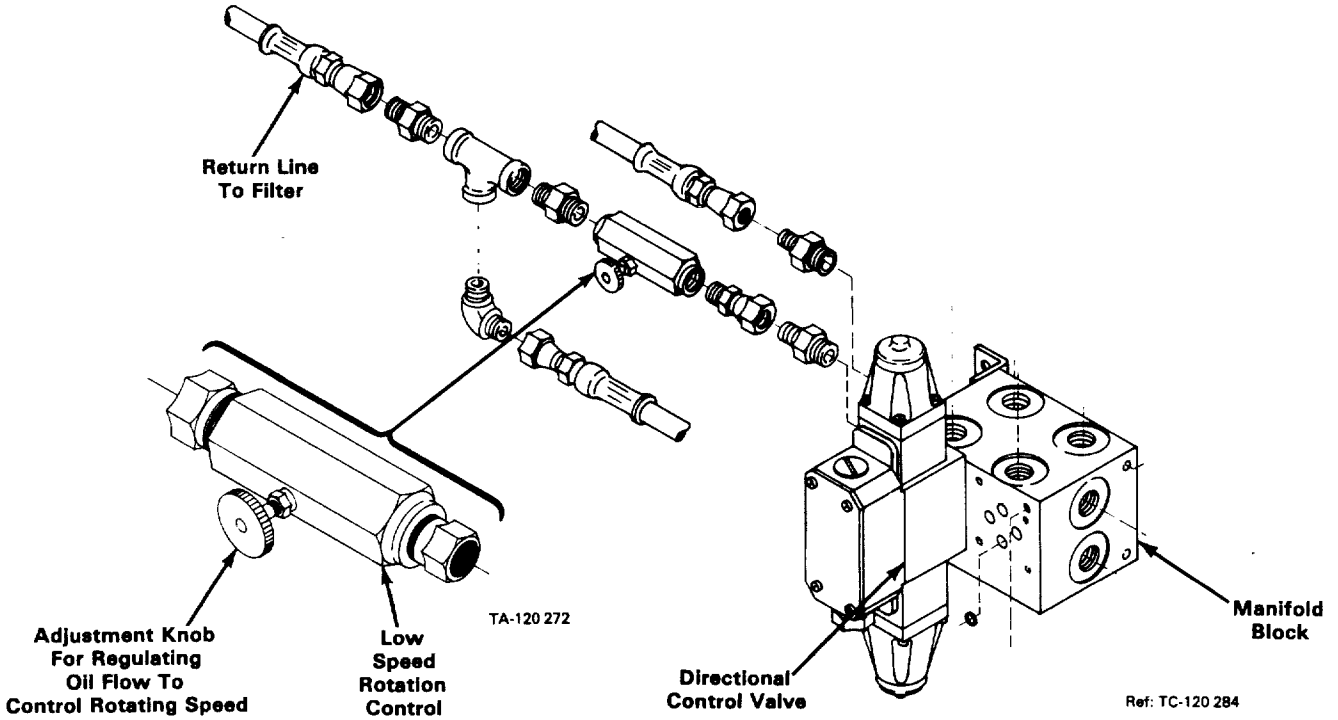

Return Line To Filter
Adjustment Knob For Regulating Oil Flow To Control Rotating Speed
Low Speed Rotation Control
TA-120 272
Directional Control Valve
Manifold Block
Ref: TC-120 284

Figure 4 - 4. Location Of Low Speed Rotation Control

To adjust mounting plate low speed rotation, proceed as follows:

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury.

- *Do not touch live electrical parts.*
- *Keep clear of pinch points.*

Turntable operation is required to properly adjust mounting plate rotation speed.

1. Remove front cover from turntable chassis.

2. Depending on the amount of weight on the turntable mounting plate, adjust time-delay relay setting (see Section 3-5).

IMPORTANT: *Rotating low-speed flow control adjustment knob counterclockwise increases final rotating speed of mounting plate and can cause knocker block to slam into hard stops. An initial setting of the low-speed rotation control can be obtained by rotating the adjustment knob fully clockwise to the closed position; then rotate adjustment knob one fully turn counterclockwise, and make fine adjustment from this coarse setting as necessary. Slight clockwise or counterclockwise rotation of the adjustment knob from its initial position will decrease or increase rotational speed respectively after the high-speed valve closes.*

3. Loosen locknut below knob, rotate adjustment knob clockwise to decrease rotational speed, or counterclockwise to increase rotational speed, and retighten locknut.

4. Manually run the program for rotating the mounting plate using the BLOCK FORWARD CONTINUOUS mode to check the time-delay relay setting that keeps the high-speed valve open and low speed rotation after the relay times out which closes the high-speed valve. Be sure to check locking pin speed during turntable operation, and adjust the pin speed control according to Section 4-6.

5. Make fine adjustments to the time-delay relay for energizing the high-speed valve, and slightly rotate adjustment knob on low-speed rotation control to increase or decrease speed as necessary.

6. Steps 4 and 5 may require repeating several times to obtain the appropriate mounting plate rotational speed without knocker block slamming into the hard stops.

7. Reinstall front cover on turntable chassis.

4 - 6. ADJUSTMENT OF LOCKING PIN SPEED CONTROL (Figure 4-5) - The adjustable locking pin speed control provides a smooth, even cylinder stroke by metering the flow of fluid during locking and unlocking pin movement. The locking pin speed control, located in the hydraulic line between the directional control valves and the rod end of the cylinder, is equipped with an adjustment knob to allow increasing or decreasing pressure and exhaust flow of hydraulic oil at pin cylinder (meter-in and meter-out flow control).

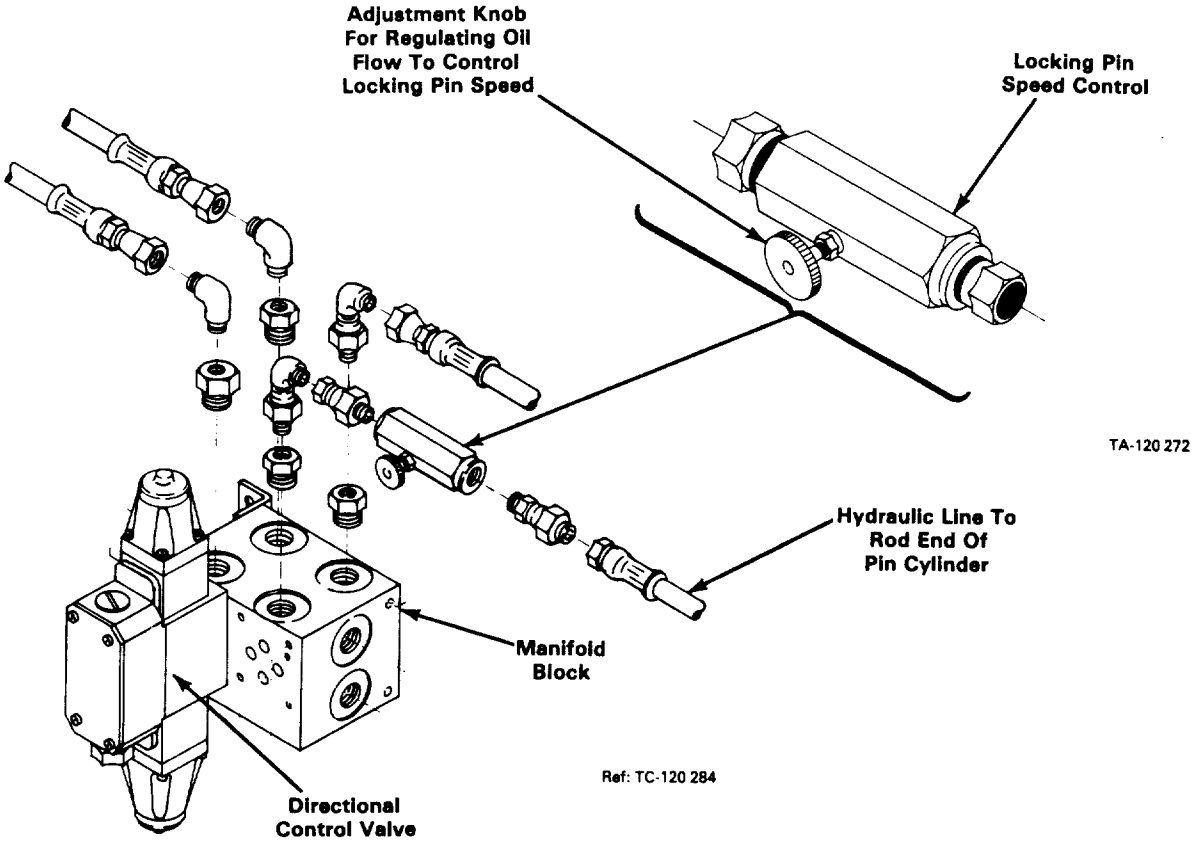

Adjustment Knob For Regulating Oil Flow To Control Locking Pin Speed
Locking Pin Speed Control
TA-120 272
Hydraulic Line To Rod End Of Pin Cylinder
Manifold Block
Ref: TC-120 284
Directional Control Valve

Figure 4 - 5. Location Of Locking Pin Speed Control

If pin speed is too slow, the locking cylinder stroke may not secure the mounting plate position after rotation. If pin speed is too fast, the locking and unlocking cylinder strokes will be excessively rapid and cause a hard, noisy stop. Locking pin speed can change as a result of adjusting the low speed rotation control which may require pin speed adjustment.

To adjust locking pin speed, proceed as follows:

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury.

- *Do not touch live electrical parts.*
- *Keep clear of pinch points.*

Turntable operation is required to properly adjust locking pin speed.

1. Remove front cover from turntable chassis.

IMPORTANT: *An initial setting of the locking pin speed control can be obtained by rotating the adjustment knob fully clockwise to the closed position; then rotate adjustment knob one full turn counterclockwise, and make fine adjustment from this coarse setting as necessary. Slight clockwise or counterclockwise rotation of the adjustment knob from its initial position will decrease or increase pin speed respectively.*

2. Loosen locknut below knob, rotate adjustment knob clockwise to decrease speed or counterclockwise to increase pin speed, and retighten locknut.

3. Manually run the program for rotation the mounting plate using the BLOCK FORWARD CONTINUOUS mode to check pin speed during both locking and unlocking movement.

4. Make fine adjustment to the locking pin speed control by slightly rotating the adjustment knob to increase or decrease speed as necessary.

5. Steps 3 and 4 may require repeating several times to obtain appropriate locking pin speed without pin slamming into receiver holes.

6. Reinstall front cover on turntable chassis.

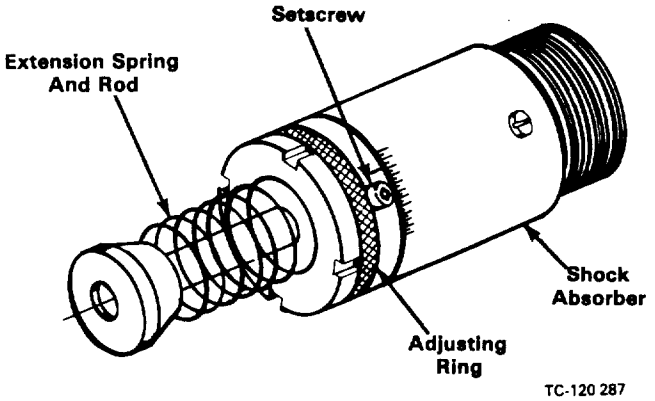


Figure 4 - 6. Shock Absorber Components

4 - 7. ADJUSTMENT OF SHOCK ABSORBERS (Figure 4-6 and 4-7) - The two hard stops on the turntable chassis are equipped with an adjustable shock absorber. The adjusting ring, located at the rod end of the sock absorber body, rotates to allow changing the amount of shock absorber cushioning. A scale from 0 to 9 on the shock absorber body indicates maximum to minimum cushioning adjustment respectively.

If cushioning is set too hard, the shock absorber will prevent knocker block contact with the hard stop as mounting plate rotation ends, and the locking pin will not secure the mounting plate. If cushioning is set too soft, the shock absorber will allow the knocker block to continue excessively rapid movement as mounting plate rotation ends causing a sudden, forceful contact with the hard stops. Both shock absorber adjustment settings should provide firm cushioning for smooth, decelerating contact between the knocker block and hard stop at the end of a clockwise or counterclockwise mounting plate rotation.

To adjust shock absorber cushioning, proceed as follows:

WARNING: MOVING PARTS can cause serious injury.

- *Keep clear of moving parts and pinch points.*

Turntable operation is required to properly adjust shock absorber cushioning.

1. Loosen setscrew securing shock absorber adjusting ring.

IMPORTANT: *The low speed rotation and amount of weight on the turntable mounting plate will determine the amount of cushioning required by the shock absorber. An initial setting of the cushioning can be obtained by rotating the adjusting ring to a setting from 3-1/2 to 6-1/2 as indicated by the adjustment scale.*

2. Rotate adjusting ring toward the 0 scale position for firmer cushioning or toward the 9 scale position for softer cushioning.

3. Manually run the program for rotating the mounting plate using the BLOCK FORWARD CONTINUOUS mode to check cushioning at the end of both clockwise and counterclockwise mounting plate rotation.

4. Make fine adjustment to cushioning of both shock absorbers by slightly rotating the adjusting rings to change cushioning for either a firmer or softer setting.

5. Steps 3 and 4 may require repeating several times to obtain appropriate shock absorber cushioning.

6. Retighten adjusting ring setscrew.

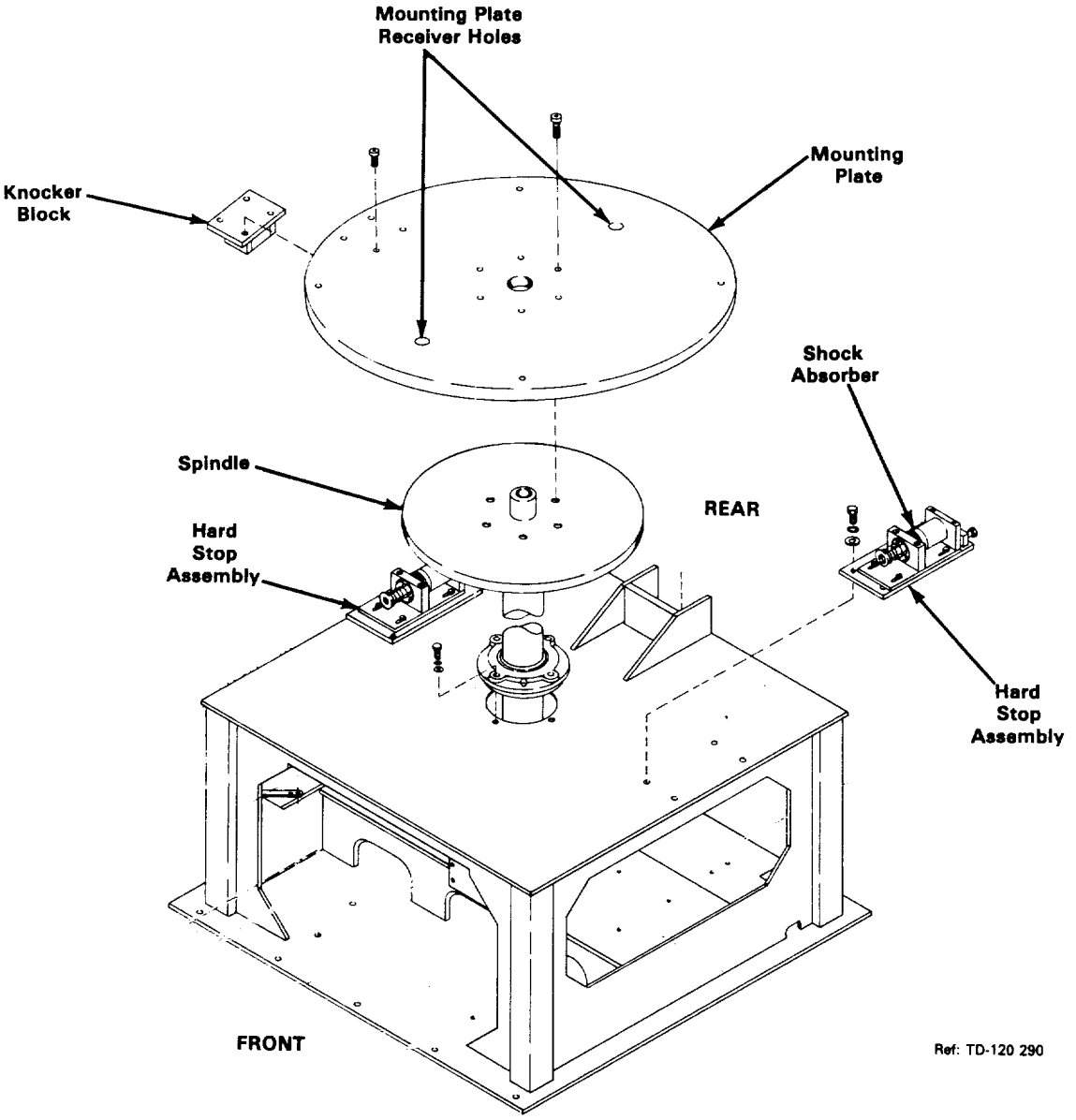


Figure 4 - 7. Components For Index Stopping Of Mounting Plate Rotation

4 - 8. SETTING HARD STOPS (Figures 4-7 and 4-8) - The two hard stops on the turntable chassis are adjustable to align mounting plate receiver holes with the locking pin for securing mounting plate position after clockwise and counterclockwise rotation.

To adjust hard stops, proceed as follows:

WARNING: MOVING PARTS can cause serious injury.

- *Keep clear of moving parts and pinch points.*

Turntable operation is required to properly adjust hard stops.

1. Loosen bolts that secure adjustment plate to hard stop mounting plate on both sides of turntable.

2. Loosen jam nuts on adjusting screws at rear of base blocks.

3. Manually run the program for rotating mounting plate using the BLOCK FORWARD CONTINUOUS mode.

4. Check mounting plate receiver hole position at the locking pin location to determine direction of hole misalignment.

IMPORTANT: *Hard stop adjustment for aligning receiver holes with locking pin is correct when knocker block moves approximately 1/32 in. (0.8 mm) away from hard stop as locking pin enters receiver hole to secure mounting plate after clockwise or counterclockwise rotation. If adjustment of hard stops does not align receiver holes with locking pin, check for proper index rotation of mounting plate (see Section 4-11C).*

5. Adjust hard stop for the side where knocker block is located to correct receiver hole misalignment.

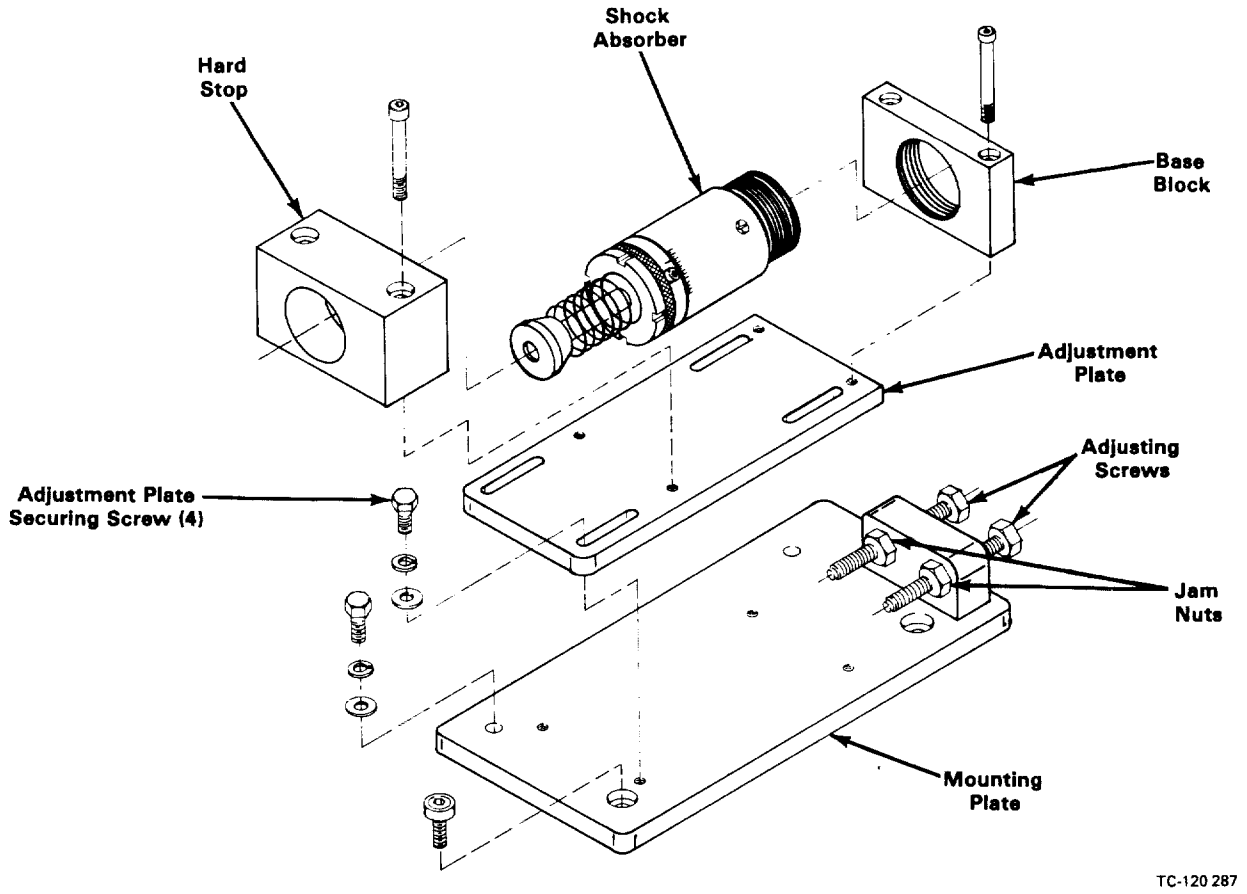


Figure 4 - 8. Components Of Hard Stop Assembly

6. Repeat steps 3, 4, and 5 to adjust remaining hard stop at opposite side of turntable chassis. Mounting plate rotation may be necessary several times for fine adjustment of both hard stops to obtain proper alignment between receiver holes and locking pin.

7. Tighten bolts that secure adjustment plates to hard stop mounting plates.

8. Be sure that adjusting screws are tight against rear of both base blocks; tighten all adjusting screw jam nuts.

4 - 9. ADJUSTMENT OF PRESSURE SWITCH FOR ACCUMULATOR (Figure 4-9) - The turntable hydraulic system is equipped with a pressure switch for sensing minimum and maximum fluid pressure in the accumulator. The accumulator supplies pressurized fluid to the various hydraulic functions during turntable operation for a pressure range set at the pressure switch.

The switch energizes the pump motor at a minimum pressure which causes fluid to flow until maximum fluid pressure is restored in the accumulator. The switch deenergizes the motor at a maximum pressure setting, and the accumulator begins supplying pressurized fluid to the various hydraulic functions again.

IMPORTANT: *The lower and upper limits of the pressure range that the pressure switch energizes and deenergizes the pump motor are 950 psi (6550 kPa) and 1250 psi (8618 kPa) respectively. If the pressure range limits are incorrect, turntable hydraulic functions will not operate properly and damage may occur to turntable components.*

To adjust pressure switch range limits, proceed as follows:

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury.
- *Do not touch live electrical parts.*
- *Keep clear of pinch points.*

Turntable operation is required to properly adjust pressure switch.

1. Remove front cover from turntable chassis.

2. Manually run the program for rotating mounting plate using the BLOCK FORWARD CONTINUOUS mode until pressure switch energizes and deenergizes the pump motor, and note minimum and maximum pressure gauge readings.

IMPORTANT: *The differential and maximum pressure adjustment controls are located on the side of the pressure switch with the pressure gauge. Upper adjustment control sets maximum pressure, and lower adjustment control is the differential setting for the lower and upper range limits. The lower adjustment control changes the range limits with regard to maximum pressure setting. Reducing the differential setting narrows the range limits which can cause the upper limit (maximum pressure adjustment setting) to decrease below specification value and lower limit to increase above specification value; likewise, increasing the differential setting expands the range limits which can cause the upper limit (maximum pressure adjustment setting) to increase above specification value. It may be necessary to adjust the differential and maximum pressure adjustment controls several times to set range limits to specified values of 950 psi (6550 kPa) and 1250 psi (8618 kPa).*

3. Adjust differential and maximum pressure controls as necessary. Rotating upper control (maximum pressure adjustment) clockwise increases pressure and counterclockwise decreases pressure. Rotating lower control (differential pressure adjustment) clockwise narrows the range limits and counterclockwise expands the range limits.

4. Repeat Steps 2 and 3 to make fine pressure switch adjustments for obtaining proper setting of pressure range limits.

5. Reinstall front cover on turntable chassis.

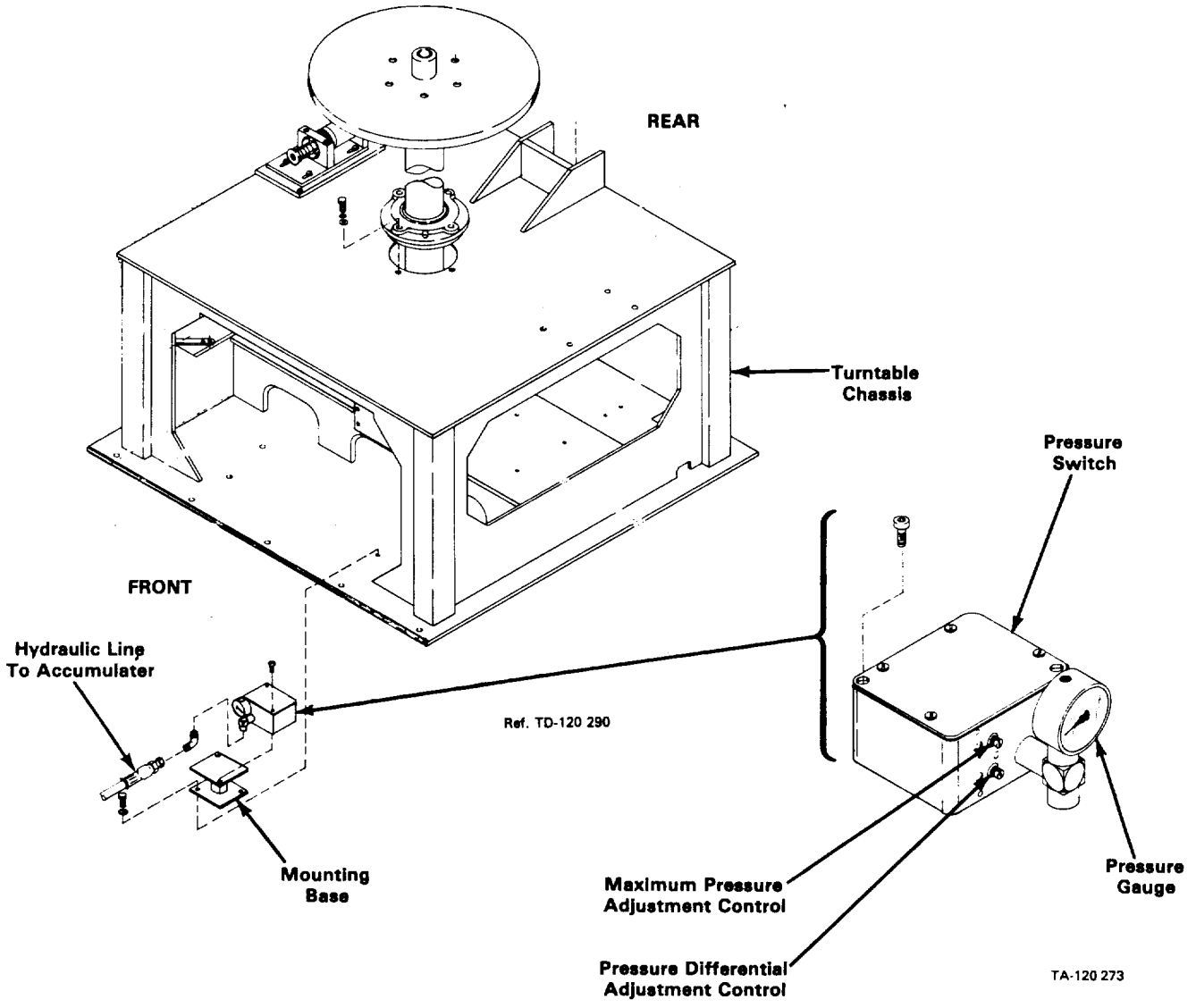


Figure 4 - 9. Location And Components Of Pressure Switch

4-10. ADJUSTMENT OF DRIVE BELT TENSION (Figure 4-10)

IMPORTANT: *The initial break-in time for the drive belt is one week of turntable operation which allows for some stretching of the belt. After operating the turntable for one week, check and tighten drive belt according to this procedure.*

The drive belt is a toothed-type timing belt and should only need tension adjustment to function properly. After the initial week of turntable operation and again after every month of operation, check the belt tension and make adjustment as necessary. To adjust drive belt tension, proceed as follows:

WARNING: ELECTRIC SHOCK can kill.
- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.
- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.
- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

1. Remove front and left side covers from turntable chassis.
2. Loosen the 4 nuts securing the rotary actuator mounting plate to the chassis base.
3. Tighten the tension adjustment bolt, located on left side of rotary actuator mounting plate, to increase belt tension. Belt should be snug, but not overtightened.
4. Retighten the 4 nuts to secure mounting plate.
5. Reinstall front and left side covers on turntable chassis.

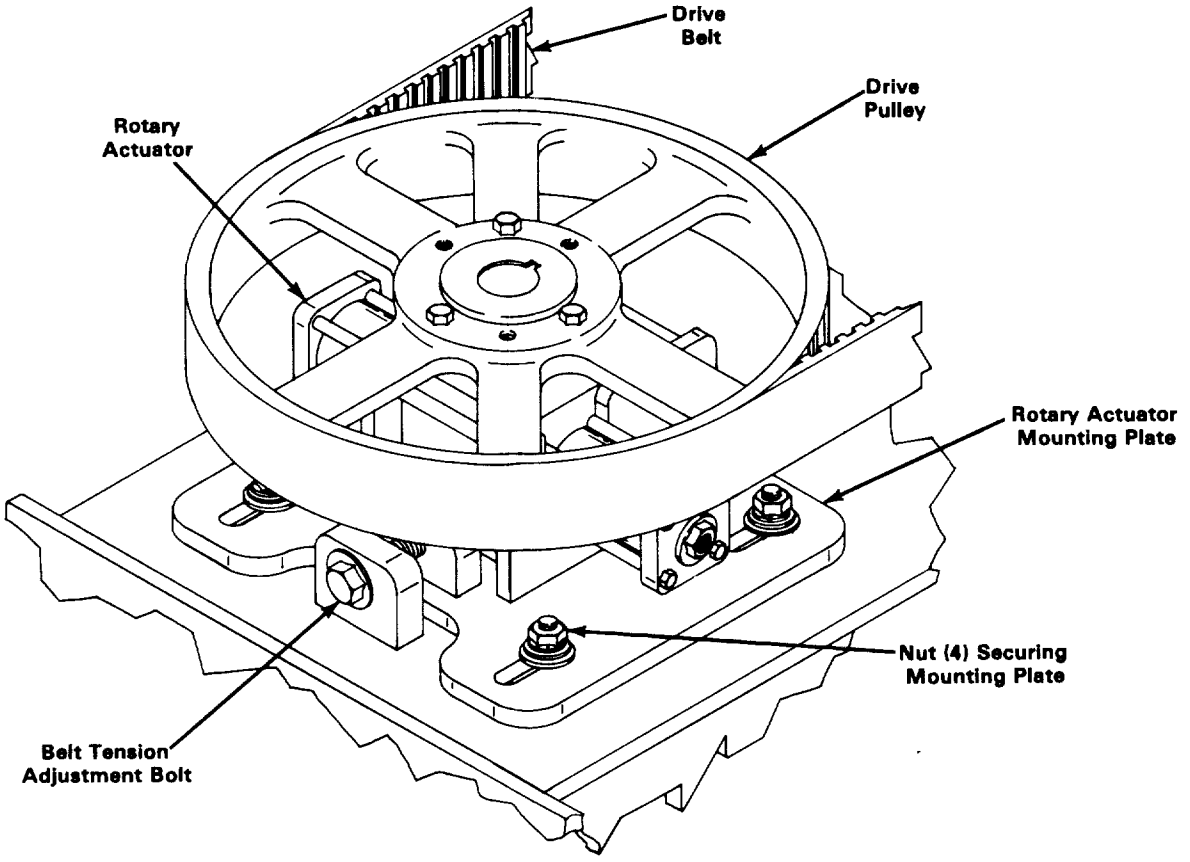


Figure 4 - 10. Components For Adjusting Drive Belt Tension

4-11. DRIVE BELT REPLACEMENT (Figure 4-11)

A. Belt Removal

The turntable spindle must be in a raised position to allow replacement of the drive belt. To ease lifting the spindle and prevent damaging turntable components, it will be necessary to retract the locking pin to release the mounting plate from its secured position (locking pin in the down position).

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury.

- *Do not touch live electrical parts.*
- *Keep clear of pinch points.*

Turntable operation is required to retract locking pin from securing mounting plate position.

1. Turn on turntable input power (energize welding power source if it is equipped with a 115 volts ac receptacle that supplies turntable input power).

2. Open hinged front cover on turntable control panel and momentarily connect a jumper lead to leads 30 and 32 at terminal strip to retract locking pin from securing mounting plate position.

3. Close and secure cover on control panel.

4. Shut down input power supply to turntable.

5. Remove front, rear, and left side covers from turntable chassis.

6. Press the push button on top of the motor/pump adapter to release pressurized fluid from accumulator and check for a zero (0) reading at pressure switch gauge.

7. Loosen the 4 nuts securing rotary actuator mounting plate to turntable base.

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

IMPORTANT: *Releasing drive belt tension when locking pin is not securing mounting plate will allow spindle to move slightly away from hard stop and shock absorber at the knocker block location.*

8. Loosen tension adjustment bolt, located on left side of rotary actuator mounting plate, to release belt tension.

9. Remove belt from drive pulley on rotary actuator.

10. Loosen setscrew in upper and lower bearing collars.

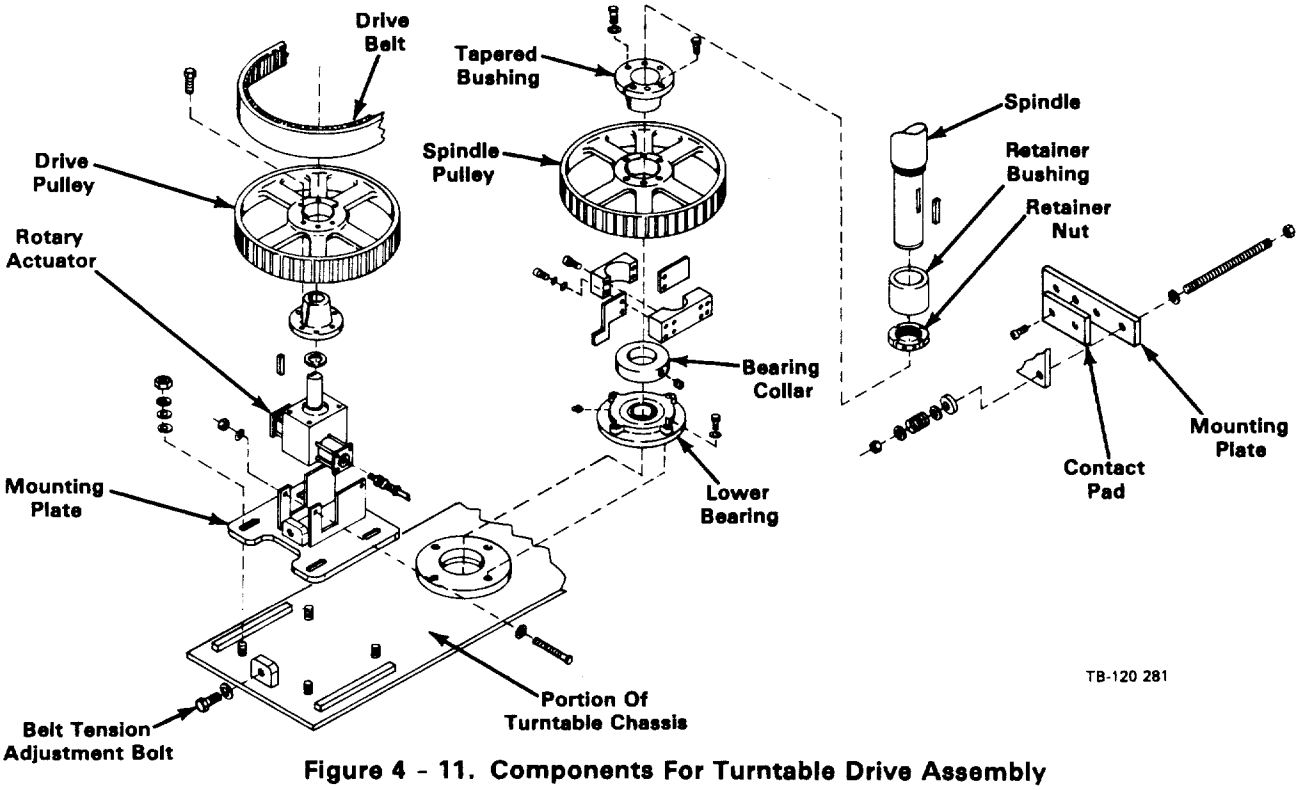


Figure 4 - 11. Components For Turntable Drive Assembly

11. Remove locknuts, flat washers, and springs that secure contact pad against retainer bushing above spindle pulley.

12. Remove contact pad assembly from mounting position, and set assembly aside.

IMPORTANT: *The spindle is secured to the upper turntable bearing by a retainer bushing and retainer nut. An adjustable hook spanner wrench (2 to 4-3/4 in.) is necessary to loosen the retainer nut on the spindle.*

13. Loosen and remove retainer nut from threaded portion of spindle allowing nut and bushing to rest on top of tapered bushing in spindle pulley.

14. Use proper lifting equipment of adequate capacity, and raise spindle up approximately 6 to 8 in. (152 to 203 mm) to provide space between bottom of spindle and lower bearing collar.

15. Remove belt from around spindle assembly through opening between spindle and lower bearing.

B. Replacement Belt Installation

1. Install replacement belt around spindle assembly through opening between bottom of spindle and lower bearing collar.

IMPORTANT: *When lowering spindle down into lower bearing inside turntable chassis, maintain mounting plate position as close to its original position before raising spindle at beginning of replacement procedure.*

2. Slowly lower spindle down while guiding end of spindle into lower bearing collar.

3. Slide retainer bushing and retainer nut up on spindle, and tighten nut using an adjustable hook spanner wrench (2 to 4-3/4 in.) to secure spindle to upper bearing on turntable chassis.

4. Install and secure contact pad assembly against retainer bushing with flat washers, springs, and locknuts. Tighten locknuts until nylon inserts engage the threaded rods.

5. Tighten setscrew in upper and lower bearing collar (to prevent indenting the spindle, do not overtighten setscrews).

IMPORTANT: *When installing replacement belt onto spindle pulley and drive pulley, maintain mounting plate position as close to its original position as possible before releasing belt tension at beginning of replacement procedure.*

6. Install replacement belt onto spindle pulley and drive pulley.

7. Tighten tension adjustment bolt, located on left side of rotary actuator mounting plate, to increase belt tension. Belt should be snug, but not overtightened.

C. Adjusting Index Rotation Of Mounting Plate

Receiver holes in the mounting plate allow the locking pin to secure the mounting plate position after a rotation. The spindle is synchronized with the rotary actuator to rotate mounting plate slightly more than 180 degrees for both clockwise and counterclockwise rotation. If index rotation of mounting plate is incorrect, alignment between receiver holes and locking pin using the hard stops will not be possible. To adjust index rotation of mounting plate, proceed as follows:

WARNING: MOVING PARTS can cause serious injury.

- *Keep clear of moving parts and pinch points. Turntable operation is required to adjust index rotation of mounting plate.*

1. Remove hard stop assembly from both sides of turntable chassis.

2. Turn on robot system input power.

IMPORTANT: *Without hard stop contact at the end of clockwise and counterclockwise mounting plate rotation, the receiver hole at the locking pin position must be located approximately 3/4 in. (19 mm) past the locking pin (measure distance between edge of locking pin and edge of receiver hole).*

3. Manually run the program for rotating mounting plate using the BLOCK FORWARD CONTINUOUS mode, and check that receiver hole location is past locking pin position by approximately 3/4 in. (19 mm) at the end of mounting plate rotation in both directions. If receiver holes are located incorrectly, adjust index rotation of mounting plate as follows:

   a. Press RESET key on Program Module, and press an EMERGENCY STOP push button.

   b. Open hinged cover on turntable control panel, and momentarily connect a jumper lead to leads 30 and 32 at terminal strip to retract locking pin.

   c. Loosen tension adjustment bolt on left side of rotary actuator mounting plate, and slip the belt on the spindle pulley by rotating spindle in the appropriate direction to position receiver hole approximately 3/4 in. (19 mm) past locking pin.

   d. Momentarily connect a jumper lead to leads 30 and 31 at terminal strip inside control panel to extend locking pin and check for approximate 3/4 in. (19 mm) distance between edge of locking pin and edge of receiver hole. Repeat Steps b and c if necessary.

e. Tighten tension adjustment bolt on left side of rotary actuator mounting plate to increase belt tension (belt should be snug, but not overtightened).

f. Close and secure cover on control panel; reset EMERGENCY STOP push button; manually run program for rotating mounting plate using the BLOCK FORWARD CONTINUOUS mode, and check receiver hole location after rotating mounting plate to opposite side.

4. Press RESET key on Program Module, and press and EMERGENCY STOP push button.

5. Tighten the 4 nuts to secure rotary actuator mounting plate to turntable base.

6. Install front, rear, and left side covers on turntable chassis.

7. Install hard stop assembly onto both sides of turntable chassis.

8. Reset EMERGENCY STOP push button, and adjust hard stops according to Section 4-8.

4-12. HYDRAULIC FITTINGS

WARNING: ELECTRIC SHOCK can kill.
- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.
- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.
- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

The turntable hydraulic system uses two types of fittings for making connections between components. Pipe fittings have tapered threads, and the seal between connections is provided by teflon tape. Compression fittings have straight threads, and the seal between connections is metal to metal contact when fittings are tightened together.

If a pipe fitting connection is loosened or completely disconnected, clean the threads on the male and female fittings, and apply teflon tape to threads on male fitting to reseal the connection. If a compression fitting connection is loosened or completely disconnected, use care when retightening the connection. Compression fittings with free-turning nuts can crack or break if overtightened.

4-13. RELEASING PRESSURIZED FLUID FROM ACCUMULATOR (Figure 4-12) - The accumulator contains pressurized hydraulic fluid during turntable operation and after the hydraulic system is shut down.

To release pressurized hydraulic fluid from accumulator, proceed as follows:

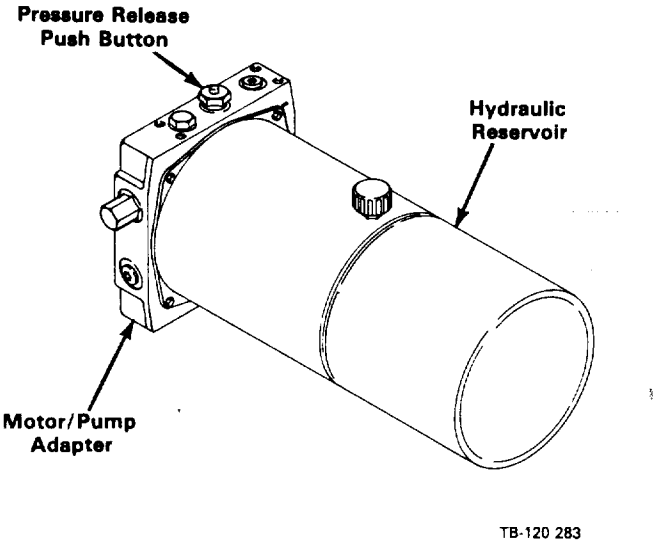


Figure 4 - 12. Location Of Pressure Release Push Button

WARNING: ELECTRIC SHOCK can kill.
- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.
- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.
- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

1. Remove front and rear cover from turntable chassis.

IMPORTANT: *The use of adequate force is needed to press the push button because hydraulic fluid is pressurized at the push button to the hydraulic system operating pressure of 950 to 1250 psi (6550 to 8618 kPa).*

2. Press the push button on top of the motor/pump adapter to release pressurized fluid from accumulator and check for a zero (0) reading at pressure switch gauge.

3. Perform the necessary service on the turntable.

4. Reinstall front and rear cover on turntable chassis.

4-14. REPLACEMENT OF PRESSURE SWITCH (Figure 4-13)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

1. Release pressurized fluid from accumulator (see Section 4-13).

2. Disconnect hydraulic hose from pressure gauge.

3. Remove the 2 screws securing pressure switch to mounting base through access holes provided in top of switch box.

4. Remove the 4 screws securing wiring cover to switch box.

5. Disconnect leads from terminal block (blue, pink, and black leads).

IMPORTANT: *Be sure to remove black jumper lead from terminal block for connection to terminal block on replacement switch.*

6. Remove nut securing 90 degree elbow to wiring cover, and remove cover.

7. Note position of pressure gauge with regard to top cover of switch box, and remove pressure gauge assembly from old switch.

8. Clean threads on pressure gauge fitting, apply teflon tape to threads, and install gauge on replacement pressure switch in position noted in Step 7.

9. Remove wiring cover from replacement switch box, insert leads and 90 degree elbow through access hole, and secure elbow to cover with nut.

10. Connect leads to terminal block as follows:

IMPORTANT: *Position terminal block so that switch wiring harness is located to right of terminal block (see Figure 4-13).*

Terminal Number	Lead Color
2	Black And One End Of Black Jumper Lead
3	Pink
5	Remaining End Of Black Jumper Lead
6	Blue

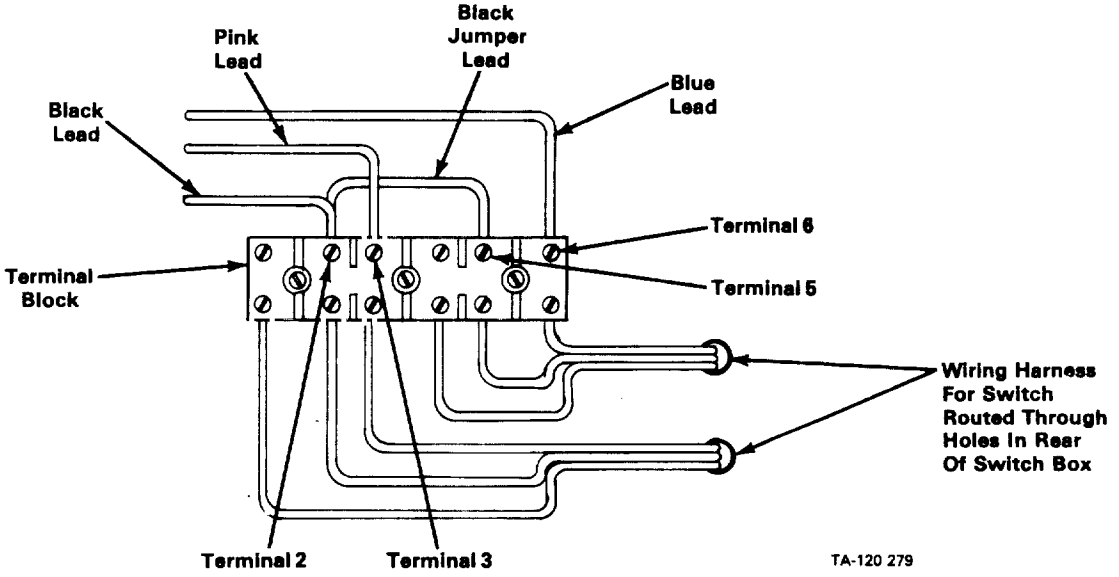


Figure 4 - 13. Lead Connections To Pressure Switch Terminal Block

11. Secure wiring cover to switch box.

12. Secure switch box to mounting base.

13. Connect hydraulic hose to pressure gauge.

14. Check and adjust pressure switch according to Section 4-9.

4-15. REPLACEMENT OF DIRECTIONAL CONTROL VALVE

Follow this procedure to replace the directional control valve for either mounting plate rotation or locking pin movement.

WARNING: ELECTRIC SHOCK can kill.
- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.
- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.
- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

1. Release pressurized fluid from accumulator (see Section 4-13).

2. Remove the 4 screws securing wiring cover to housing for terminal blocks.

3. Disconnect leads from terminal blocks as follows:

   a. Leads for valve that controls mounting plate rotation are 14 (white), 26 (blue), and 27 (brown).

   b. Leads for valve that controls locking pin movement are 14 (white), 24 (red), and 25 (yellow).

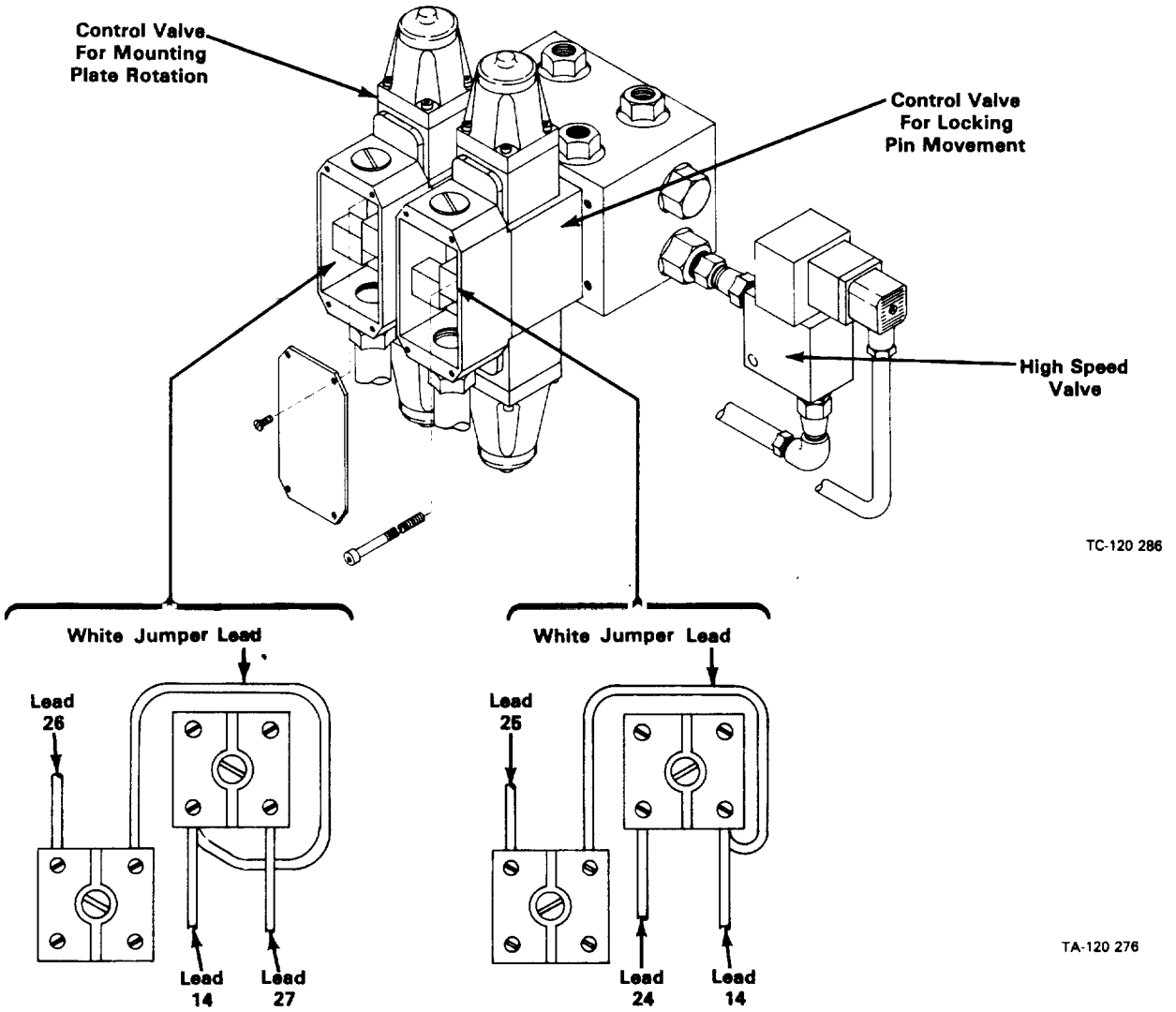


Figure 4 - 14. Lead Connections To Terminal Blocks Of Control Valves

IMPORTANT: *Be sure to remove white jumper lead from terminal blocks for connection to replacement valve terminal blocks.*

4. Remove the 4 screws inside housing for terminal blocks that secure control valve to manifold block.

5. Remove control valve from threaded flexible conduit fitting.

6. Remove wiring cover from housing for terminal blocks on replacement control valve.

IMPORTANT: *Position top and bottom of control valve using the letters BTA on side of valve body casting. The letters BTA should be on left side of valve body with letter B at top when viewing terminal blocks.*

7. Remove threaded plug from bottom of housing for terminal blocks.

8. Insert leads through access hole where plug was removed in Step 7, and secure threaded conduit fitting to housing.

9. Connect leads to appropriate terminal block locations according to Figure 4-14.

IMPORTANT: *Be sure that contact surface of manifold block and control valve are clean. Apply a light coat of hydraulic oil to O-rings, and be sure that they are properly set into the contact surface seats before installing valve.*

10. Install and secure control valve to manifold block with the 4 screws removed in Step 4 (see Figure 4-15).

11. Install and secure wiring cover on housing for terminal blocks.

4-16. REPLACEMENT OF ROTARY ACTUATOR (Figure 4-16)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

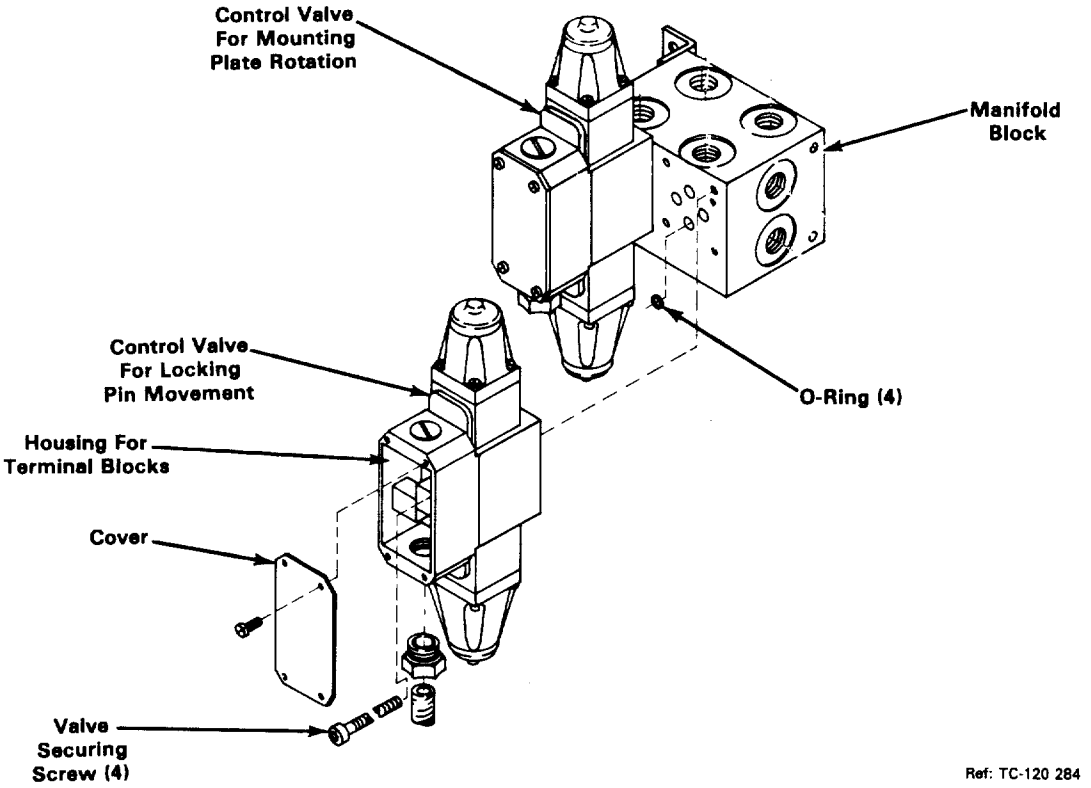


Figure 4 - 15. Control Valve Installation

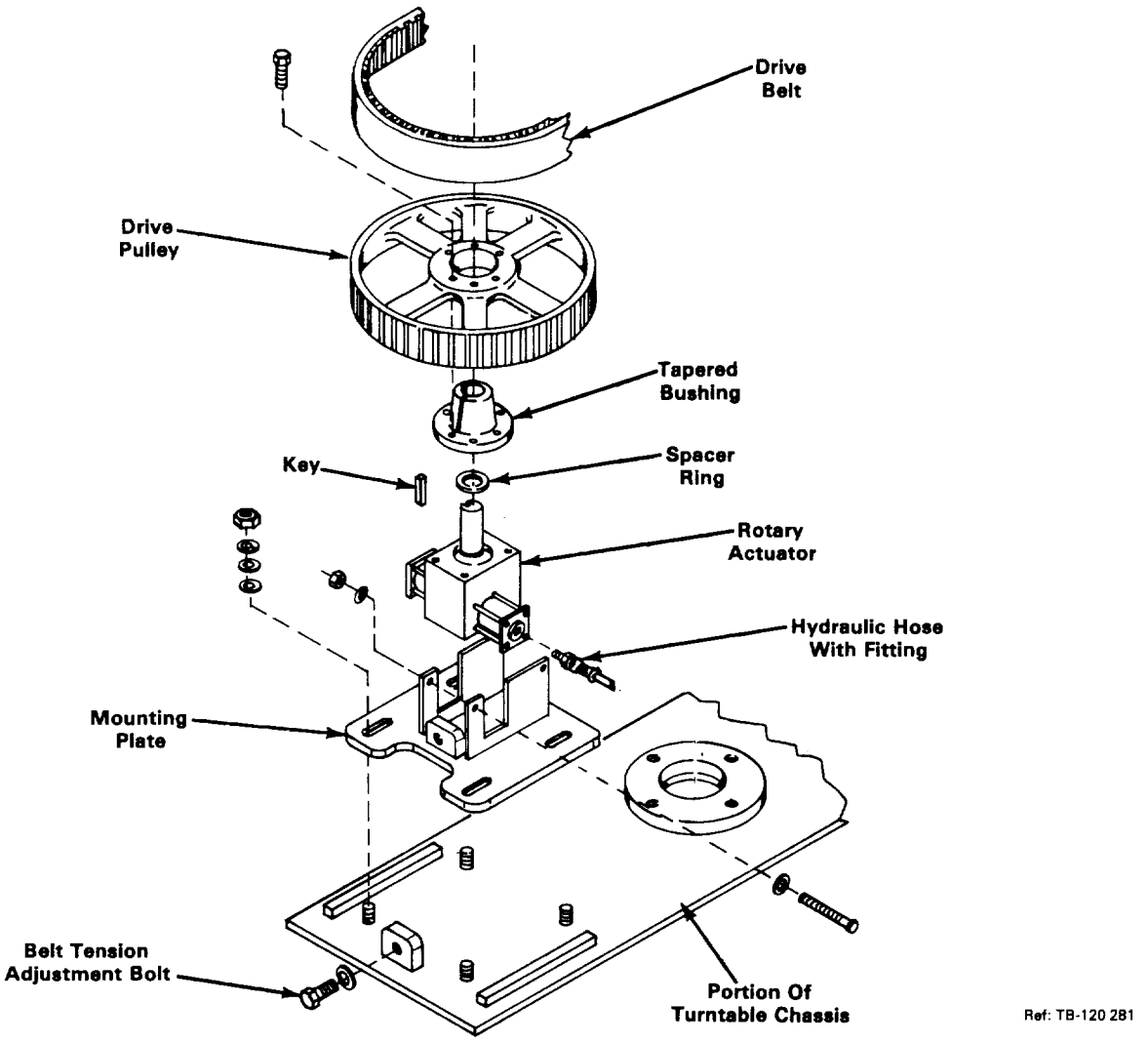


Figure 4 - 16. Rotary Actuator Drive Components

A. Removal Of Rotary Actuator

1. Remove front, rear, and left side covers from turntable chassis.
2. Release pressurized fluid from accumulator (see Section 4-13).
3. Loosen the 4 nuts securing rotary actuator mounting plate to turntable base.
4. Remove tension adjustment bolt on left side of rotary actuator mounting plate.
5. Remove belt from drive pulley.
6. Disconnect the 2 hydraulic hoses from rotary actuator.
7. Remove nuts and washers from studs at base of rotary actuator mounting plate.
8. Lift rotary actuator assembly up and out of turntable from left side of chassis.
9. Remove hydraulic fittings from rotary actuator ports.
10. Remove the 3 bolts that secure the tapered bushing in the drive pulley.
11. Tighten the 3 pusher bolts to separate the tapered bushing from the pulley hub.
12. Remove pulley from tapered bushing.
13. Remove tapered bushing and key from rotary actuator shaft.
14. Remove spacer ring from rotary actuator shaft.
15. Remove the 2 bolts above rotary actuator from top of mounting plate.
16. Turn bottom of mounting plate over so that it is facing to the side, and remove the 4 bolts securing bottom of rotary actuator to mounting plate base.

17. Remove rotary actuator from mounting plate.

B. Installation Of Rotary Actuator

1. Install replacement rotary actuator onto mounting plate and secure bottom of actuator with the 4 bolts that were removed in Step 16 of Section A.

2. Turn mounting plate over so that bottom of plate is on the work surface, and install the 2 bolts above rotary actuator that were removed in Step 15 of Section A.

3. Clean threads on hydraulic fittings removed in Step 9 of Section A, apply teflon tape to threads, and install fittings into rotary actuator ports.

4. Install rotary actuator assembly into turntable chassis.

5. Install washers and nuts onto studs for securing rotary actuator assembly to turntable base, but do not tighten nuts.

6. Install tension adjustment bolt into left side of rotary actuator assembly.

7. Connect the 2 hydraulic hoses to the rotary actuator.

8. Install spacer ring onto rotary actuator shaft removed in Step 14 of Section A.

9. Install key in shaft, and place tapered bushing onto shaft by aligning keyway.

10. Loosen the pusher bolts in drive pulley so that end of bolts are flush with bottom of pulley hub.

IMPORTANT: *When installing pulley onto tapered bushing, be sure to line up bolt holes in pulley hub and bushing.*

11. Install pulley onto tapered bushing.

IMPORTANT: *When securing tapered bushing and pulley together, be sure drive pulley aligns with spindle pulley.*

12. Install the 3 bolts removed in Step 10 of Section A into pulley hub, and secure tapered bushing and pulley together by tightening bolts to a torque of approximately 25 to 30 ft. lbs. (34 to 41 N·m).

13. Tighten pusher bolts until snug against tapered bushing.

14. Install belt onto drive pulley.

15. Adjust belt tension according to Section 4-10.

16. Manually run the program for rotating mounting plate using the BLOCK FORWARD CONTINUOUS mode to check rotary actuator assembly. Make any necessary adjustments following proper procedures.

17. Reinstall front, rear, and left side covers on turntable chassis.

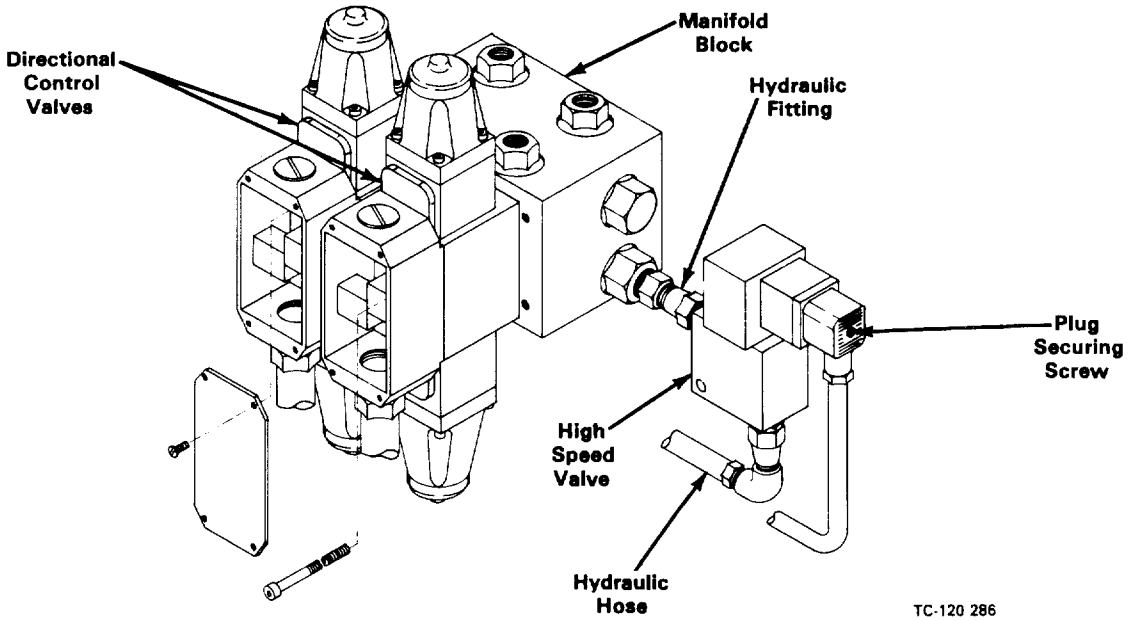


Figure 4 - 17. Location Of High Speed Valve

4 - 17. REPLACEMENT OF HIGH-SPEED VALVE (Figure 4-17)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

1. Release pressurized fluid from accumulator (see Section 4-13).
2. Disconnect hydraulic hose from lower fitting on valve.
3. Loosen upper fitting, and disconnect valve from manifold block.
4. Remove screw from rear of electrical plug, and disconnect plug from solenoid.
5. Remove hydraulic fittings from valve.
6. Clean threads on fittings, apply teflon tape to threads, and install fittings in proper locations on replacement valve.
7. Connect plug to replacement valve solenoid, and secure with screw removed in Step 4.
8. Connect valve to upper fitting on manifold.
9. Connect hydraulic hose to lower fitting on valve.
10. Manually run the program for rotating mounting plate using the BLOCK FORWARD CONTINUOUS mode to check high-speed valve operation. Make necessary adjustments following proper procedures (see Sections 3-5 and 4-5).
11. Reinstall front cover on turntable chassis.

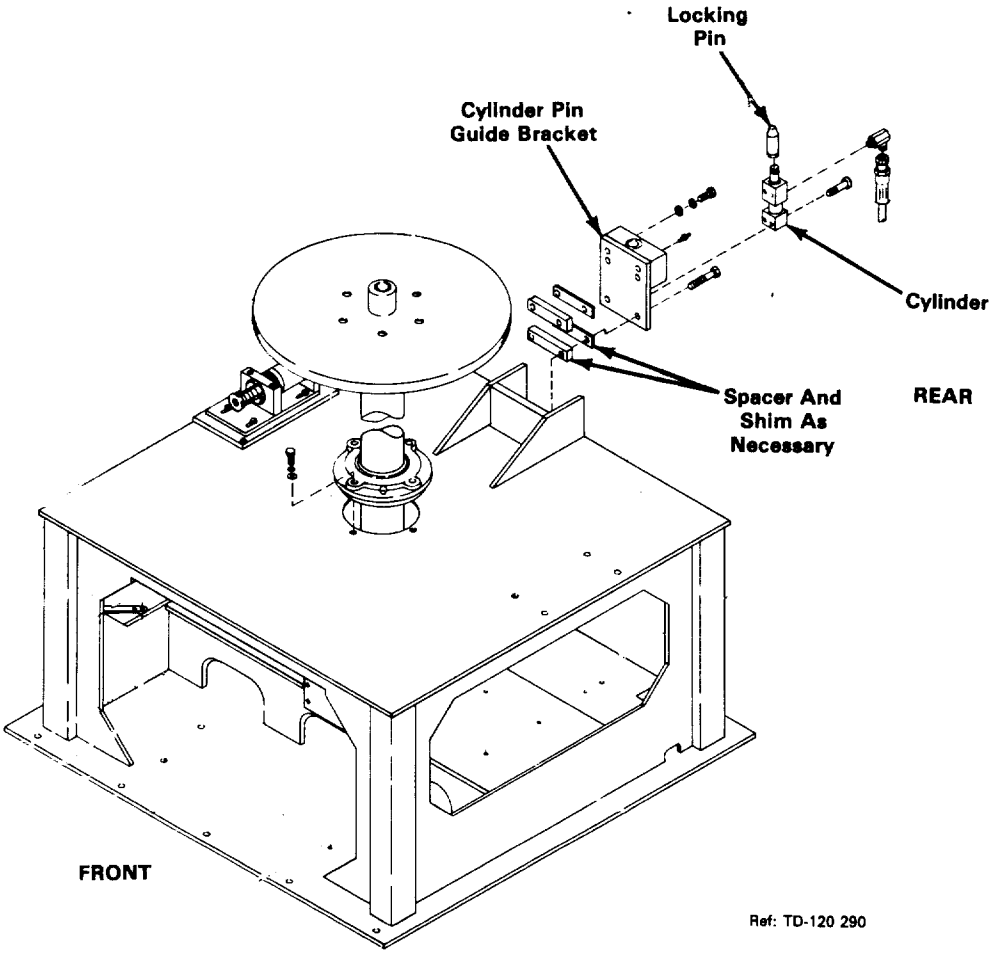


Figure 4 - 18. Location Of Locking Pin Cylinder

4-18. REPLACEMENT OF LOCKING PIN CYLINDER (Figures 4-18 and 4-19)

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury.

- *Do not touch live electrical parts.*
- *Keep clear of pinch points.*

Turntable operation is required to retract locking pin from securing mounting plate position.

1. Turn on turntable input power (energize welding power source if it is equipped with a 115 volts ac receptacle that supplies turntable input power).

2. Open hinged cover on turntable control panel and momentarily connect a jumper lead to leads 30 and 32 at terminal strip to retract locking pin from securing mounting plate position.

3. Close and secure cover on control panel.

4. Shut down input power supply to turntable.

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

5. Release pressurized fluid from accumulator (see Section 4-13).

IMPORTANT: *When removing cylinder pin guide bracket from turntable chassis, be sure to retain spacer bars and shim stock, if applicable, located at rear of mounting bracket, for reinstalling guide bracket with proper alignment after cylinder replacement.*

6. Remove the 4 bolts securing the cylinder pin guide bracket to turntable chassis and lower guide bracket onto base of turntable.

7. Mark and disconnect the 2 hydraulic hoses from cylinder fittings (hose at base of cylinder extends locking pin and hose at head of cylinder retracts locking pin).

8. Remove hydraulic fittings from cylinder.

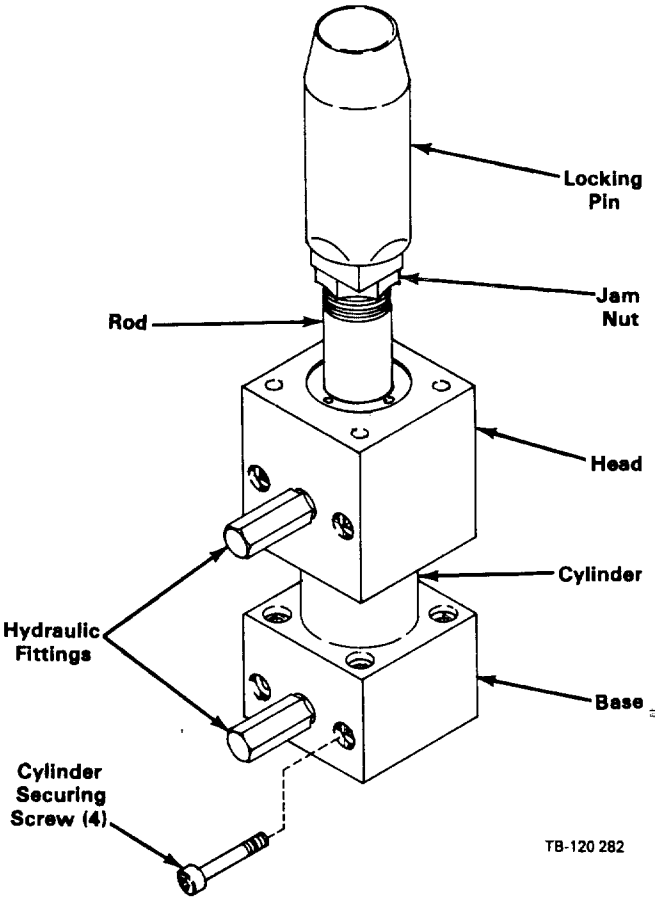


Figure 4 - 19. Cylinder And Locking Pin Components

9. Remove the 4 screws securing cylinder to bracket.

10. Remove cylinder and locking pin from bracket.

11. Use a wrench of proper size to hold cylinder rod, and loosen jam nut at base of locking pin.

12. Continue to hold cylinder rod secure, and use a wrench of proper size to remove pin from rod.

13. Remove jam nut from old cylinder rod, and install it on rod of replacement cylinder rod.

14. Install locking pin onto end of replacement cylinder rod, and be sure cylinder rod is in fully retracted position.

15. Install locking pin on end of cylinder rod into pin guide being sure that cylinder ports are facing away from bracket, and secure cylinder to bracket with the 4 screws removed in Step 9.

16. Adjust locking pin on threaded rod so that top of pin is flush with upper seal in pin guide, and tighten jam nut against base of locking pin.

17. Clean threads on hydraulic fittings removed in Step 8, apply teflon tape to threads, and install fittings on replacement cylinder.

18. Connect the 2 hydraulic hoses to cylinder (adjust fitting positions as necessary to provide clearance between hose fittings).

19. Install the cylinder pin guide bracket onto turntable chassis, and secure with the 4 bolts removed in Step 6 (be sure to install spacer bars and shim stock, if applicable, at rear of bracket to provide proper locking pin alignment with receiver holes).

20. Manually run the program for rotating mounting plate using the BLOCK FORWARD CONTINUOUS mode to check cylinder operation. Make any necessary adjustments following proper procedures.

4 - 19. REPLACEMENT OF PROXIMITY SWITCH (Figures 4-20 and 4-21).

WARNING: ELECTRIC SHOCK can kill.
- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.
- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.
- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

1. Remove front cover from turntable chassis.

2. Loosen the 2 screws securing the proximity switch module, and remove module from switch housing.

3. Mark and disconnect the 2 leads from the housing terminals.

4. Remove the 2 screws securing switch housing to mounting bracket.

5. Remove cord strain relief and cord from housing.

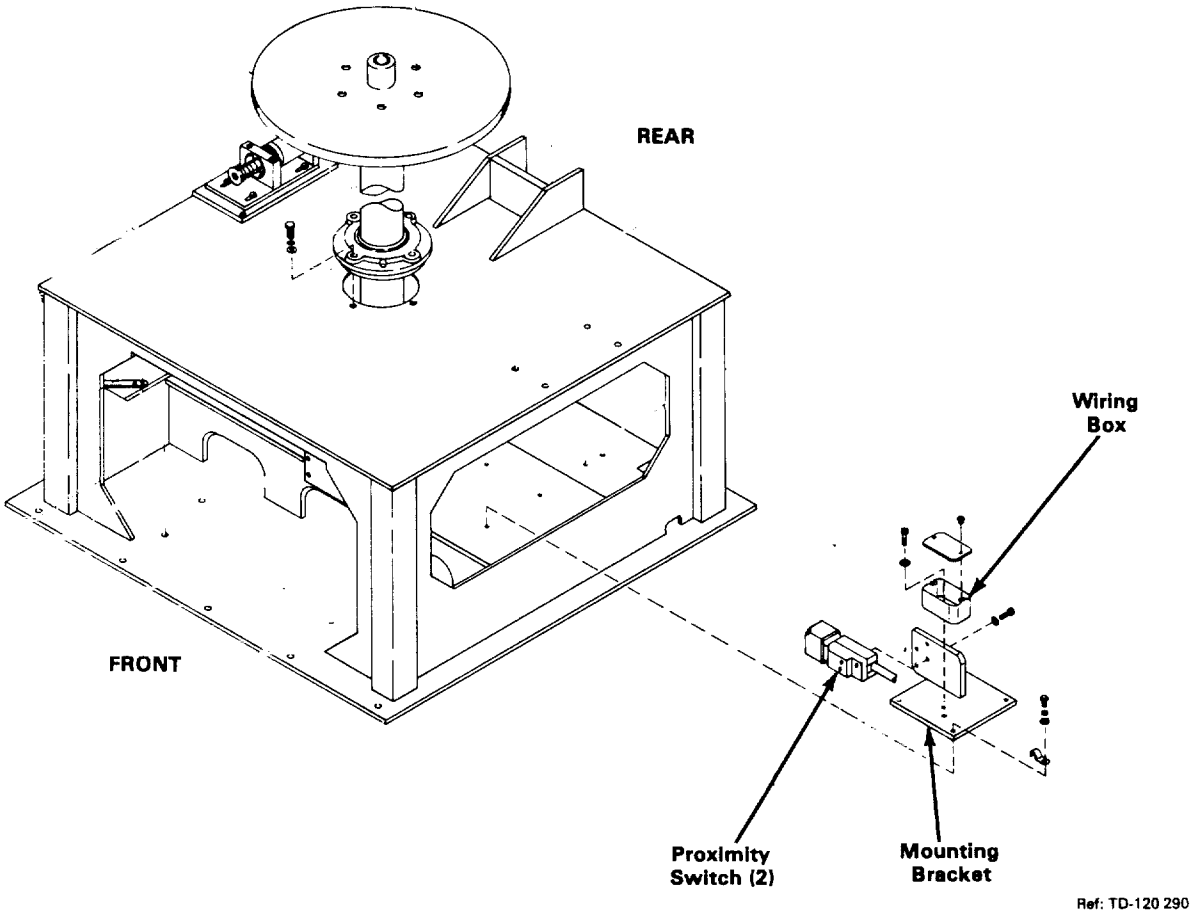


Figure 4 - 20. Location Of Proximity Switches

IMPORTANT: *Remove replacement proximity switch module from housing to allow lead connections to housing terminals.*

6. Insert cord and strain relief into replacement switch housing.

7. Install housing to mounting bracket with the 2 screws removed in Step 4, slide housing toward spindle so that screws are located at bottom of slotted mounting holes, and secure housing to mounting bracket.

8. Connect the 2 leads marked in Step 3 to the correct housing terminals. Tighten the cord strain relief on housing.

9. Install and secure proximity switch module to housing.

10. Manually run the program for rotating mounting plate using the BLOCK FORWARD CONTINUOUS mode to check proximity switch operation.

11. Reinstall front cover on turntable chassis.

4 - 20. RECHARGING THE ACCUMULATOR (Figure 4-22)

WARNING: PRESSURIZED ACCUMULATOR can kill or cause serious injury if accumulator ruptures or explodes.

- *Keep accumulator away from excessive heat and always keep protective valve cap and valve guard installed over valve stem when handling accumulator to prevent valve damage.*

The accumulator is pre-charged with a dry nitrogen gas, and the recharging procedure should only by done by a qualified service technician.

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

1. Remove rear cover from turntable chassis.

2. Release pressurized fluid from accumulator (see Section 4-13).

3. Disconnect the 2 hydraulic hoses from accumulator.

4. Loosen the clamp bolt securing the accumulator, and remove accumulator from turntable.

WARNING: RECHARGING ACCUMULATOR WITH INCORRECT GAS can kill or injure personnel if gas burns or explodes under compression with oil.

- *Do not use oxygen or air to recharge accumulator.*
- *Do not recharge accumulator below 25 percent of maximum system pressure of 1500 psi (10342 kPa).*
- *Maintain recommended accumulator gas pressure.*

Use a dry nitrogen gas, and follow recharging instructions that appear on the accumulator.

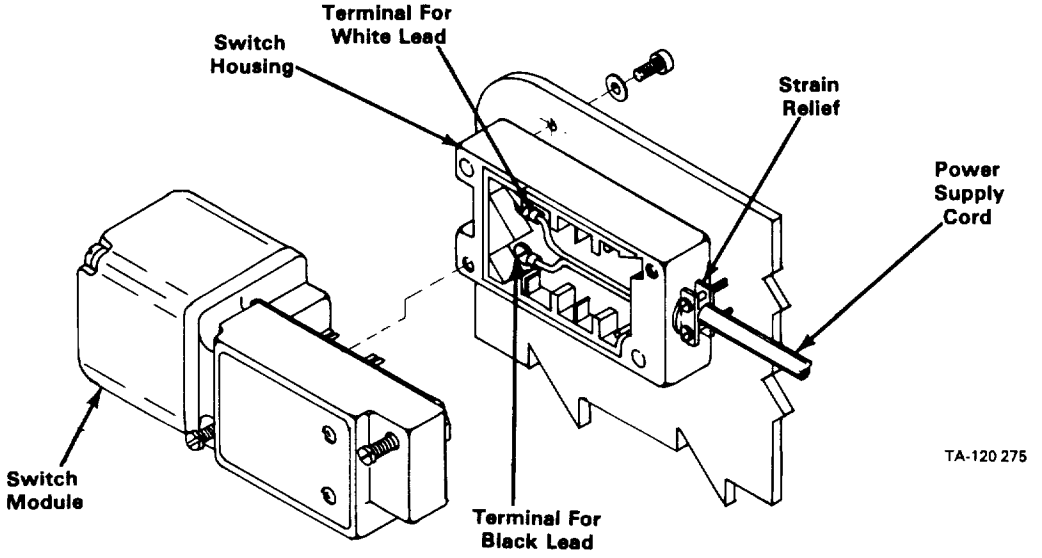


Figure 4 - 21. Proximity Switch Components

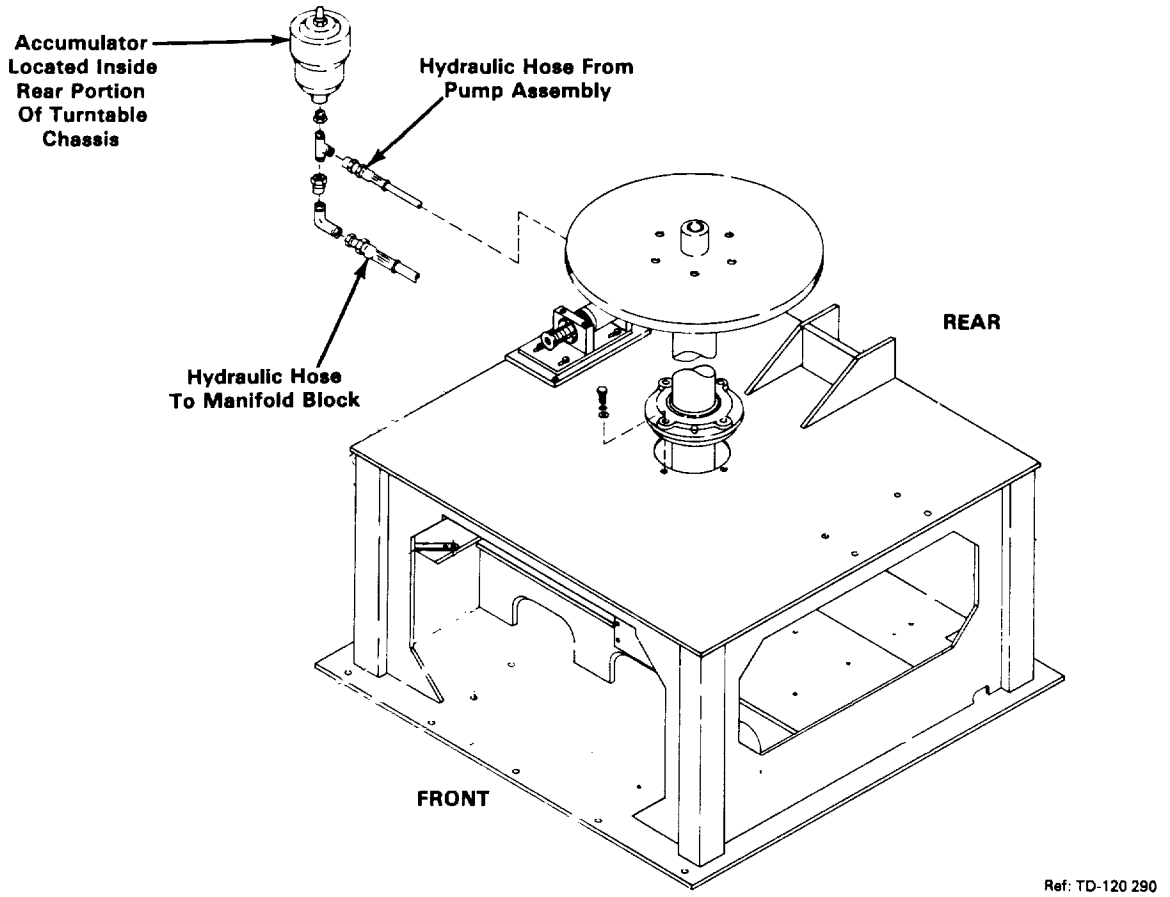


Figure 4 - 22. Location Of Accumulator

5. Have the accumulator recharged by a qualified service station.

6. Reinstall and secure accumulator in mounting clamp.

7. Connect the 2 hydraulic hoses as follows:

   a. The hose from the hydraulic pump assembly connects to the upper fitting on accumulator.

   b. The hose from the manifold block for directional control valves connects to the lower fitting on accumulator.

8. Manually run the program for rotating mounting plate using the BLOCK FORWARD CONTINUOUS mode to check the hydraulic system pressure at the pressure switch gauge.

9. Reinstall rear cover on turntable chassis.

4-21. REPLACEMENT OF MOTOR/PUMP AND RESERVOIR ASSEMBLY

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

1. Remove rear cover from turntable chassis.

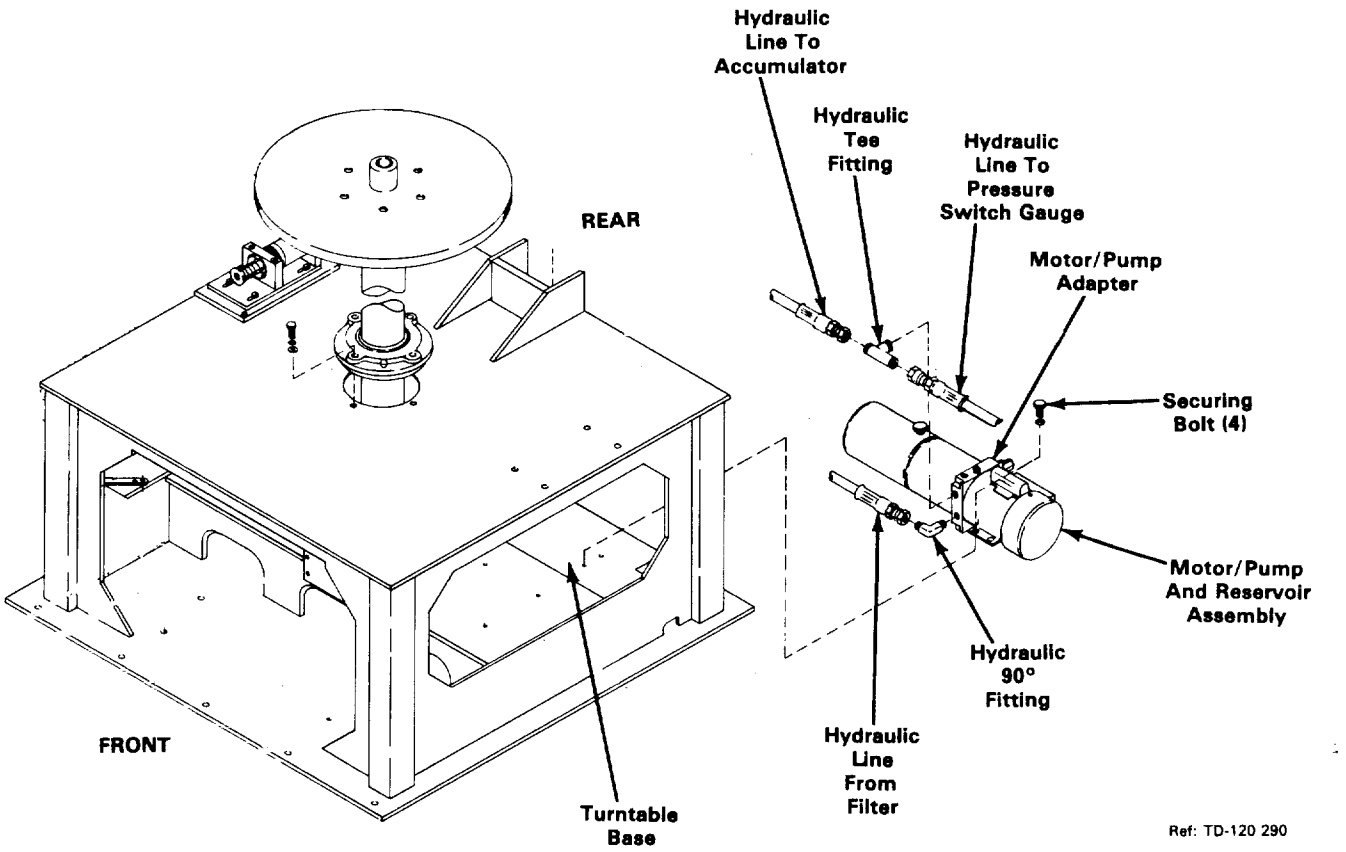


Figure 4 - 23. Location And Components Of Motor/Pump And Reservoir Assembly

2. Release pressurized fluid from accumulator (see Section 4-13).
3. Remove screws and cover from motor wiring box.
4. Mark and disconnect input power leads from motor leads.
5. Remove retainer nut from flexible conduit fitting.
6. Remove fitting and leads from wiring box.
7. Disconnect the 3 hydraulic hoses from fittings on motor/pump adapter.
8. Remove the 4 bolts securing motor/pump and reservoir assembly to turntable base.
9. Remove motor/pump and reservoir assembly from turntable.
10. Remove hydraulic fittings from motor/pump adapter.
11. Clean threads on hydraulic fittings removed in Step 10, apply teflon tape to threads, and install fittings on motor/pump adapter of replacement motor/pump and reservoir assembly (see Figure 4-23).
12. Install replacement motor/pump and reservoir assembly on turntable base, and secure assembly with the 4 bolts removed in Step 8.
13. Remove screws and cover from replacement motor wiring box, and remove knock-out blank in bottom of box.
14. Insert leads and conduit fitting in bottom hole of wiring box, and secure fitting with retainer nut.
15. Connect input power leads to motor leads.
16. Install and secure wiring box cover.
17. Connect the 3 hydraulic hoses to hydraulic fittings on motor/pump adapter (see Figure 4-23).
18. Fill reservoir with hydraulic fluid (see Section 4-4).
19. Manually run the program for rotating mounting plate using the BLOCK FORWARD CONTINUOUS mode to check motor/pump and reservoir assembly operation. Recheck fluid level in reservoir after operation (see Section 4-4).

4-22. FUSES (Figure 4-24)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

Fuses F1 and F2, rated at 15 amperes, protect the control circuit and transformer against overload. Should F1 or F2 open, the turntable would be inoperative.

Fuses F3 and F4, rated at 1 ampere, protect the proximity switches against overload. Should either F3 or F4 open, the corresponding proximity switch would be inoperative.

To replace an open fuse, proceed as follows:

1. Open hinged cover on control panel.
2. Locate fuse block inside control panel.
3. Remove open fuse from fuse block.

CAUTION: IMPROPER FUSES can damage this unit.

- *If replacement becomes necessary, use only fuses of the proper size, type, and rating.*

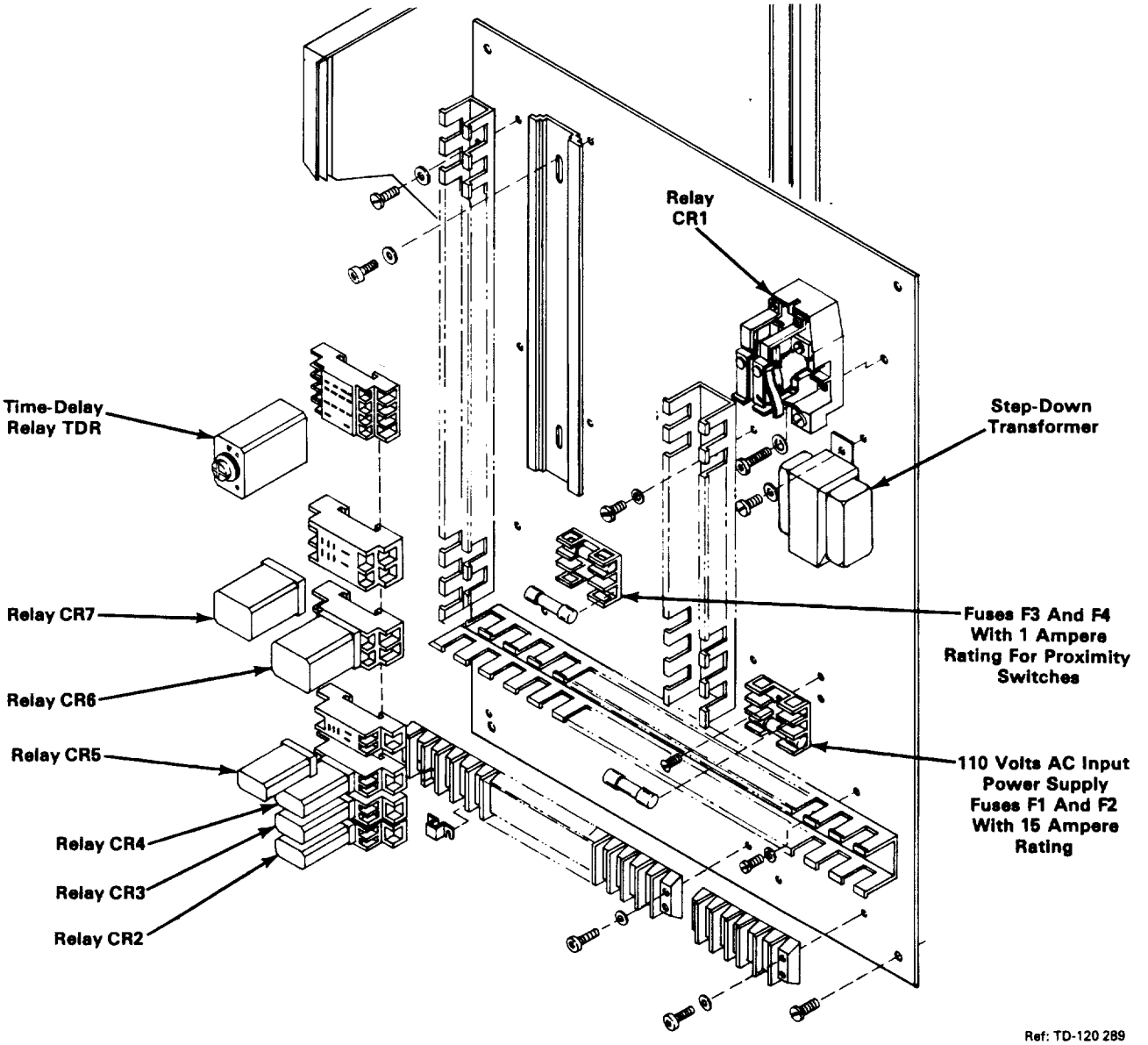


Figure 4 - 24. Location Of Fuses Inside Control Panel

4. Install replacement fuse into fuse block.

5. Close and secure hinged cover.

4-23. TROUBLESHOOTING CHARTS

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down turntable, welding power source, and robot control, and disconnect input power employing "lockout/tagging procedures" before inspecting or servicing.*

Lockout/tagging procedures consist of removing plug from receptacle, padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep clear of pinch points.*

PRESSURIZED HYDRAULIC FLUID can cause serious injury.

- *Release hydraulic fluid pressure according to Section 4-13 before touching any hydraulic components.*

Hydraulic fluid pressure is present even though electrical power is disconnected.

Troubleshooting to be performed only by qualified persons.

It is assumed that the unit was properly installed according to Section 2 of this manual, the operator is familiar with the function of controls, the turntable was working properly, and that the trouble is not related to the robot operation or welding process. The following charts are to diagnose and provide remedies for some of the troubles that may develop in this turntable.

Use these charts in conjunction with the circuit diagram and hydraulic diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, the nearest Factory Authorized Service Station should be contacted. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly followed.

ELECTRICAL TROUBLESHOOTING

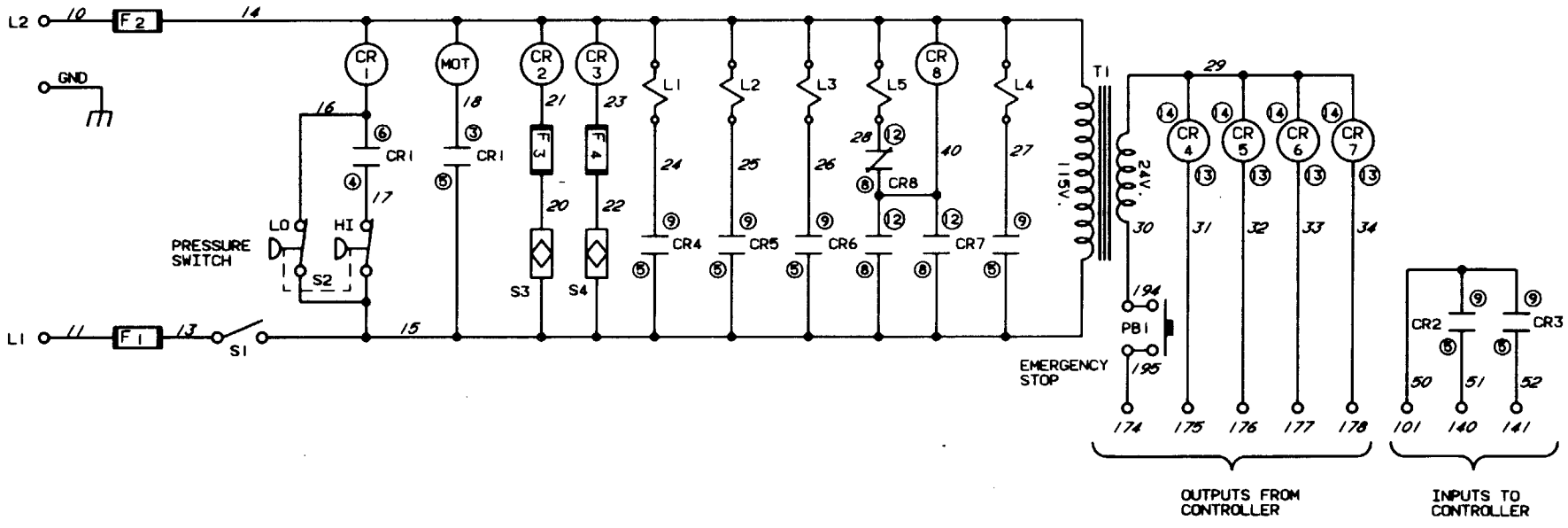
TROUBLE	PROBABLE CAUSE	REMEDY
Unit completely inoperative.	Input power cord not secure in receptacle.	Secure power cord plug in receptacle.
	Power switch on control panel.	Place power switch in ON position.
	Fuse F1 and/or F2 open.	Replace F1 and/or F2 (see Section 4-22).
Motor inoperative.	Relay CR1.	Replace CR1.
	Pressure switch inoperative.	Replace pressure switch (see Section 4-14).
No output signal from proximity switch(es).	Fuse F3 and/or F4 open.	Replace F3 and/or F4 (see Section 4-22).
	No input signal received by control unit.	Check program (see Section 3-1). Check operation control cord lead connections (see Section 2-2). Check control unit input ports (see Robot Owner's Manual).
	Relay CR2 and/or CR3.	Replace CR2 and/or CR3.
	Proximity switch(es).	Check switch module LEDs for illumination. If LEDs are not illuminated, replace switch(es) (see Section 4-19).
No locking pin movement.	Relay CR4 and/or CR5.	Replace CR4 and/or CR5.
	No 24 volts ac input from transformer.	Replace transformer.

TROUBLE	PROBABLE CAUSE	REMEDY
No locking pin movement.	No output signal from control unit.	Check program (see Section 3-1). Check operation control cord lead connections (see Section 2-2). Check control unit output ports (see Robot Owner's Manual).
No high-speed cycle as mounting plate starts rotation.	Time-delay relay TDR setting too low.	Increase relay time setting (see Section 3-5).
	Time-delay relay TDR inoperative.	Replace TDR.
	High-speed valve inoperative.	Replace high-speed valve (see Section 4-17).
Mounting plate does not rotate.	Relay CR6 and/or CR7.	Replace CR6 and/or CR7.
	No 24 volts as output from transformer.	Replace transformer.
	No output signal from control unit.	Check program (see Section 3-1). Check operation control cord lead connections (see Section 2-2). Check control unit output ports (see Robot Owner's Manual).
No work continuity for welding.	Work cable connection or contact pad.	Tighten work cable connection or adjust spring tension for contact pad (see Section 2-1).

HYDRAULIC/MECHANICAL TROUBLESHOOTING

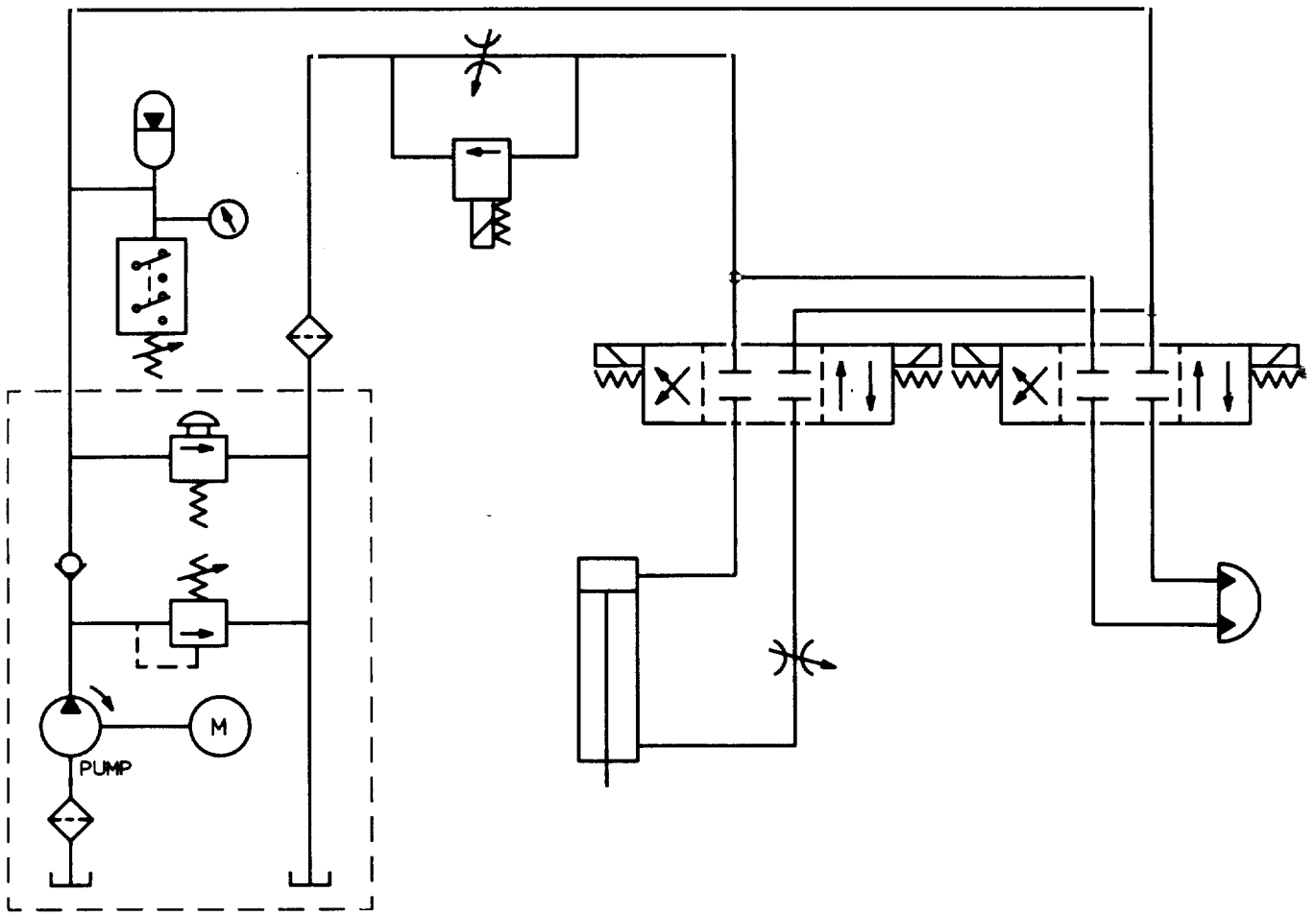
TROUBLE	PROBABLE CAUSE	REMEDY
Mounting plate rotation not smooth.	No bearing lubrication.	Lubricate bearings (see Section 4-2A).
Slow mounting plate rotation.	No bearing lubrication.	Lubricate bearings (see Section 4-2A).
	Low-speed flow control.	Adjust low-speed flow control (see Section 4-5).
	Incorrect pressure switch adjustment.	Adjust pressure switch (see Section 4-9).
	Pressure switch inoperative.	Replace pressure switch (see Section 4-14).
	Accumulator gas charge low.	Recharge accumulator (see Section 4-20).
	Accumulator inoperative.	Replace accumulator.
	System relief valve or check valve on motor/pump adapter inoperative.	Contact nearest Factory Authorized Service Station.
Locking pin cylinder inoperative.	No lubrication.	Lubricate locking pin (see Section 4-2B).
	Directional control valve for cylinder.	Replace valve (see Section 4-15).
Locking pin slamming into receiver holes.	Locking pin speed control.	Adjust locking pin speed control (see Section 4-6).

TROUBLE	PROBABLE CAUSE	REMEDY
Locking pin cylinder not holding in up position.	Locking pin cylinder.	Replace cylinder (see Section 4-18).
Mounting plate not holding position at end of rotation.	Rotary actuator.	Replace rotary actuator (see Section 4-16).
Mounting plate not rotating.	Drive belt broken.	Replace drive belt (see Section 4-11).
	Directional control valve for rotary actuator.	Replace valve (see Section 4-15).
	Rotary actuator inoperative.	Replace rotary actuator (see Section 4-16).
Mounting plate knocker block slamming into hard stops.	Air in hydraulic system.	Add hydraulic fluid to reservoir and rotate mounting plate several times (see Section 4-4).
	Time-delay relay TDR setting too high.	Decrease relay time setting (see Section 3-5).
	Low-speed flow control.	Adjust low-speed flow control (see Section 4-5).
	Shock absorber cushion adjustment.	Adjust shock absorber (see Section 4-7).
Locking pin not entering receiver holes in mounting plate.	Drive belt slipping.	Tighten belt tension (see Section 4-10).
	Incorrect setting of hard stops.	Set hard stops (see Section 4-8).
	Low-speed flow control open too far.	Adjust low-speed flow control (see Section 4-5).



Circuit Diagram No. B-121 159-A

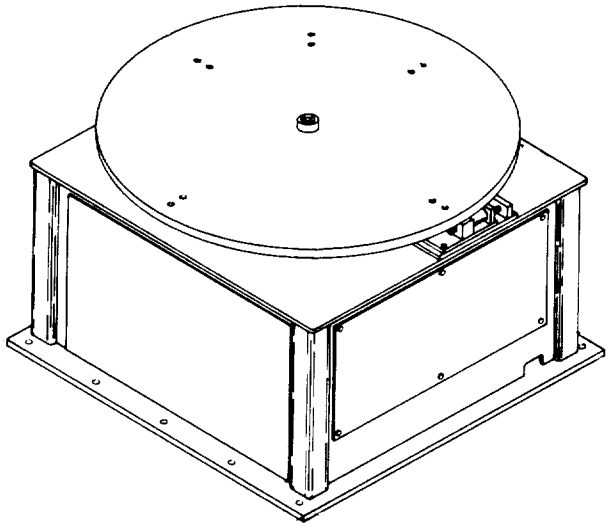
Figure 4 - 25. Electrical Circuit Diagram



Circuit Diagram No. A-120 980

Figure 4 - 26. Hydraulic Circuit Diagram

July 1988 FORM: OM-890



PARTS LIST

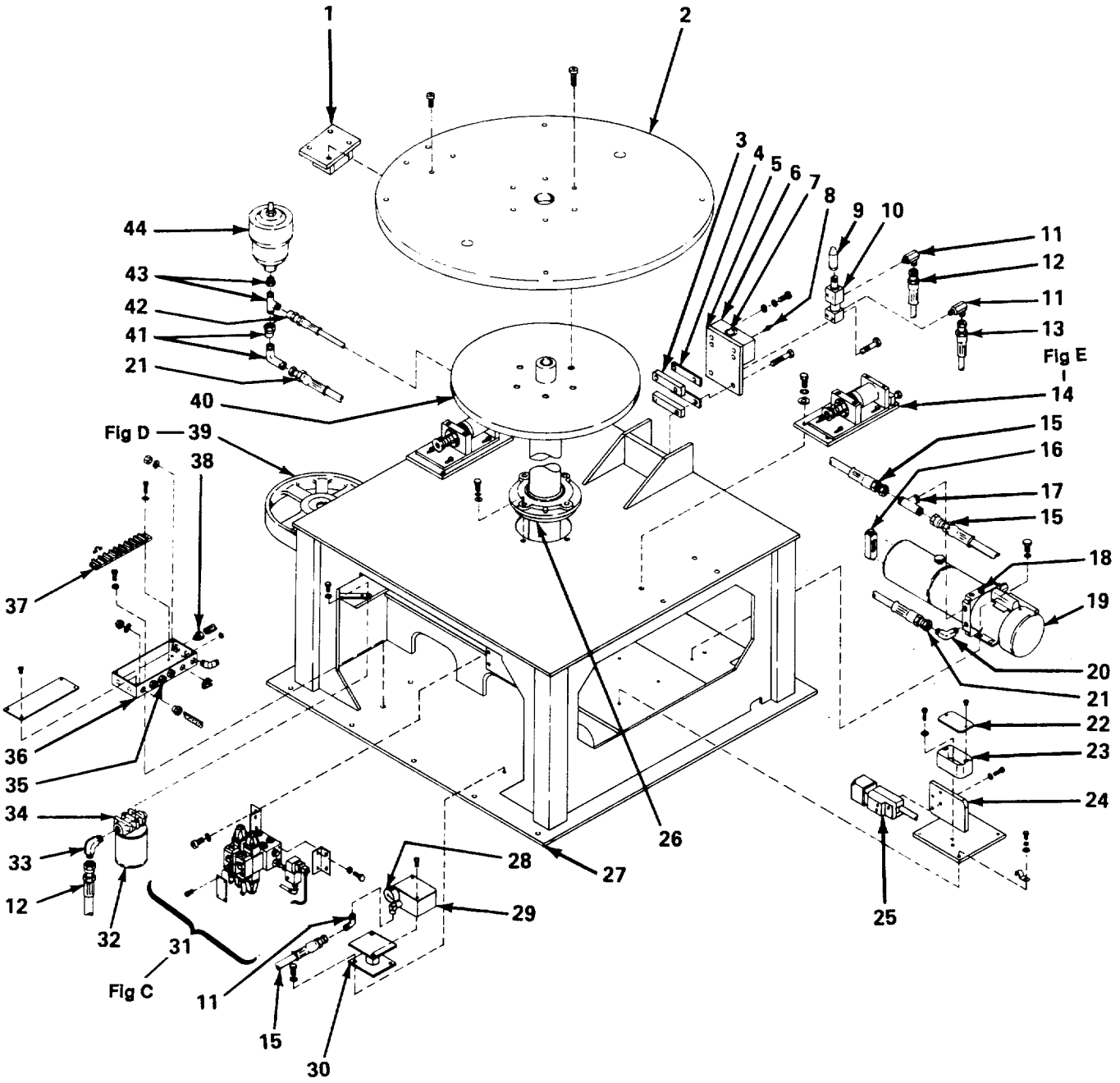


Figure A - Main Assembly

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure A			**Main Assembly**	
1		122 072	HARD STOP ASSEMBLY	1
2		122 087	MOUNTING TABLE	1
3		122 099	SPACER BAR 0.5 x 1.5 x 6	2
4		122 100	SHIM STOCK	2
5		122 101	PIN CYLINDER MTG PLATE	1
6		122 102	PIN BLOCK 2.5 x 3	1
7		122 103	GREASE SEAL	1
8		122 125	GREASE ZERK	1
9		122 074	HARDEN LOCATOR PIN	1
10		122 073	PIN ACTUATION HYDRAULIC CYLINDER	1
11		122 544	FITTING HOSE	3
12		122 564	HOSE HYDRAULIC	2
13		122 565	HOSE HYDRAULIC	1
14		Figure E	SHOCK ABSORBER ASSEMBLY (Pg 8)	1
15		122 562	HOSE HYDRAULIC	3
16		122 070	SIGHT GAUGE	1
17		122 556	FITTING HOSE	1
18		122 075	PRESSURE RELIEF VALVE	1
19	MOT	122 104	HYDRAULIC PUMP/MOTOR ASSEMBLY	1
20		122 555	FITTING HOSE	1
21		122 560	HOSE HYDRAULIC	2
22		122 107	ELECTRICAL HANDY BOX LID	1
23		122 106	ELECTRICAL HANDY BOX	1
24		122 105	PROXIMITY SWITCH MTG BRACKET	1
25	S3,4	117 189	SWITCH PROXIMITY	2
26		122 098	MAIN BEARING	1
27		122 088	CHASSIS WELDMENT	1
		122 089	SIDE COVER PANEL 16 x 34	1
		122 090	FRONT/BACK COVER PANEL 23 x 36	1
28		122 071	PRESSURE GAUGE 0-1500 PSI	1
29	S2	117 195	PRESSURE SWITCH	1
30		122 163	PRESSURE GAUGE, MTG BRACKET	1
31		Figure C	HYDRAULIC CONTROL ASSEMBLY (Pg5)	1
32		117 193	FILTER ELEMENT	1
33		122 553	FITTING HOSE	1
34		122 161	HYDRAULIC FILTER MTG BOSS	1
35		122 558	FITTING HOSE	3
36		122 094	ELECTRICAL JUNCTION BOX	1
37		122 095	TERMINAL STRIP	1
38		122 559	FITTING HOSE	1
39		Figure D	DRIVE ASSEMBLY (Pg 7)	1
40		122 097	MAIN SPINDLE 24 INCH DIA	1
41		122 547	FITTING HOSE	1
42		122 563	HOSE HYDRAULIC	1
43		122 554	FITTING HOSE	1
44		122 096	ACCUMULATOR TANK 0.5 GAL	1

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

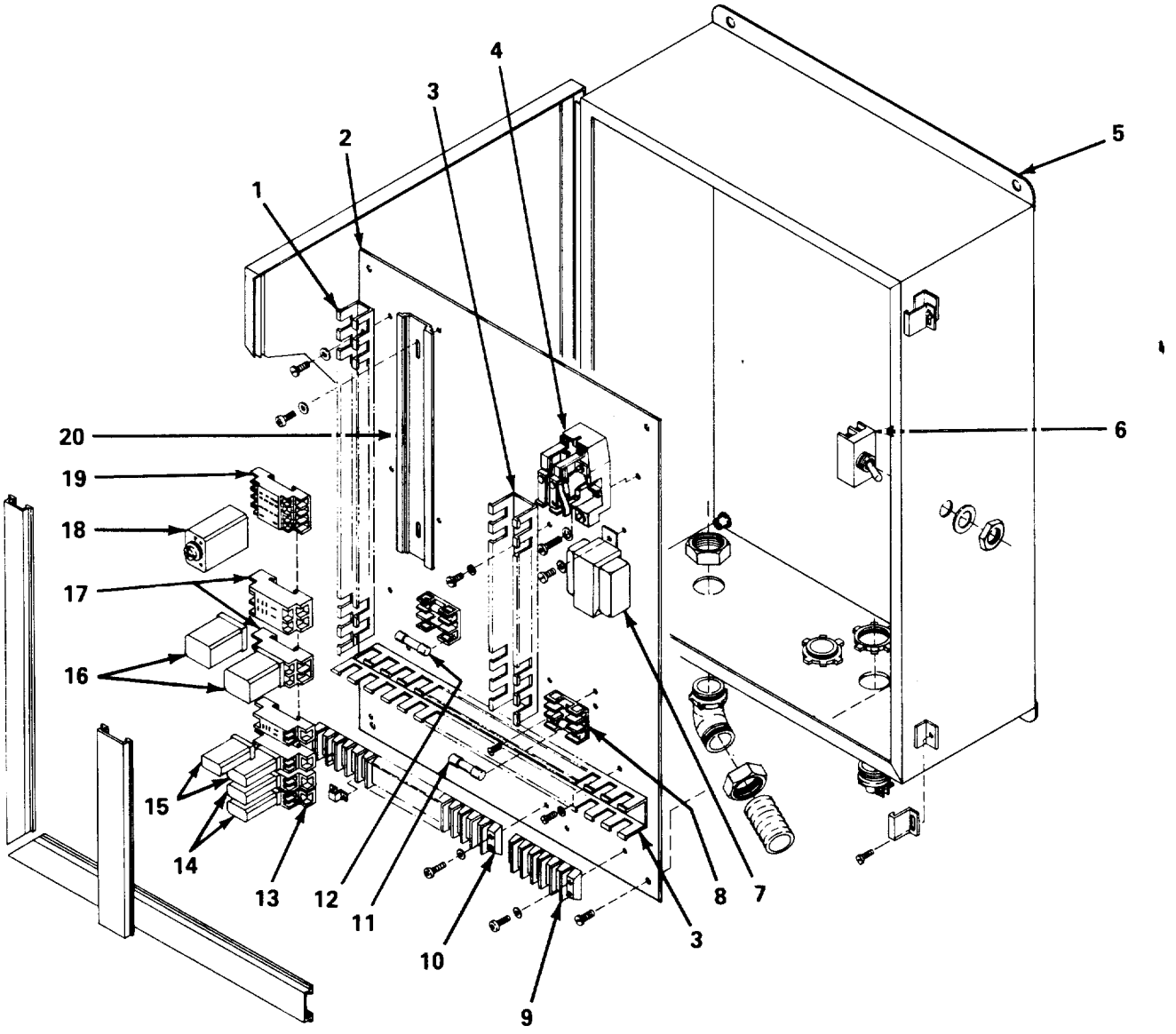


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Figure B - Control Panel

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure B			**Control Panel**	
1		122 122	ELECTRICAL WIREWAY	1
2		122 109	ELECTRICAL PANEL	1
3		122 121	ELECTRICAL WIREWAY	2
4	CR1	122 123	RELAY, P&B	1
5		122 108	ELECTRICAL ENCLOSURE	1
6	S1	122 117	TOGGLE SWITCH, ON/OFF	1
7	T1	122 112	CONTROL CIRCUIT TRANSFORMER 110/24 VOLTS	1
8		122 118	FUSE BLOCK	2
9		122 111	TERMINAL STRIP	1
10		122 110	TERMINAL STRIP	1
11	F1	*122 119	FUSE, 15 AMP AGC	1
12	F3,4	*122 120	FUSE, 1.0 AMP AGC	2
13		122 113	RELAY SOCKET BASE	4
14	CR4,5	117 190	RELAY, ENCLOSED 24 VOLTS AC SPDT	2
15	CR2,3	117 191	RELAY, ENCLOSED 120 VOLTS AC SPDT	2
16	CR6,7	119 691	RELAY, DPDT	2
17		122 114	RELAY SOCKET BASE	2
18	CR8	119 690	RELAY DPDT	1
19		122 115	TIME DELAY RELAY SOCKET BASE	1
20		122 116	RELAY TRACK MOUNT	1

*Recommended Spare Parts.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

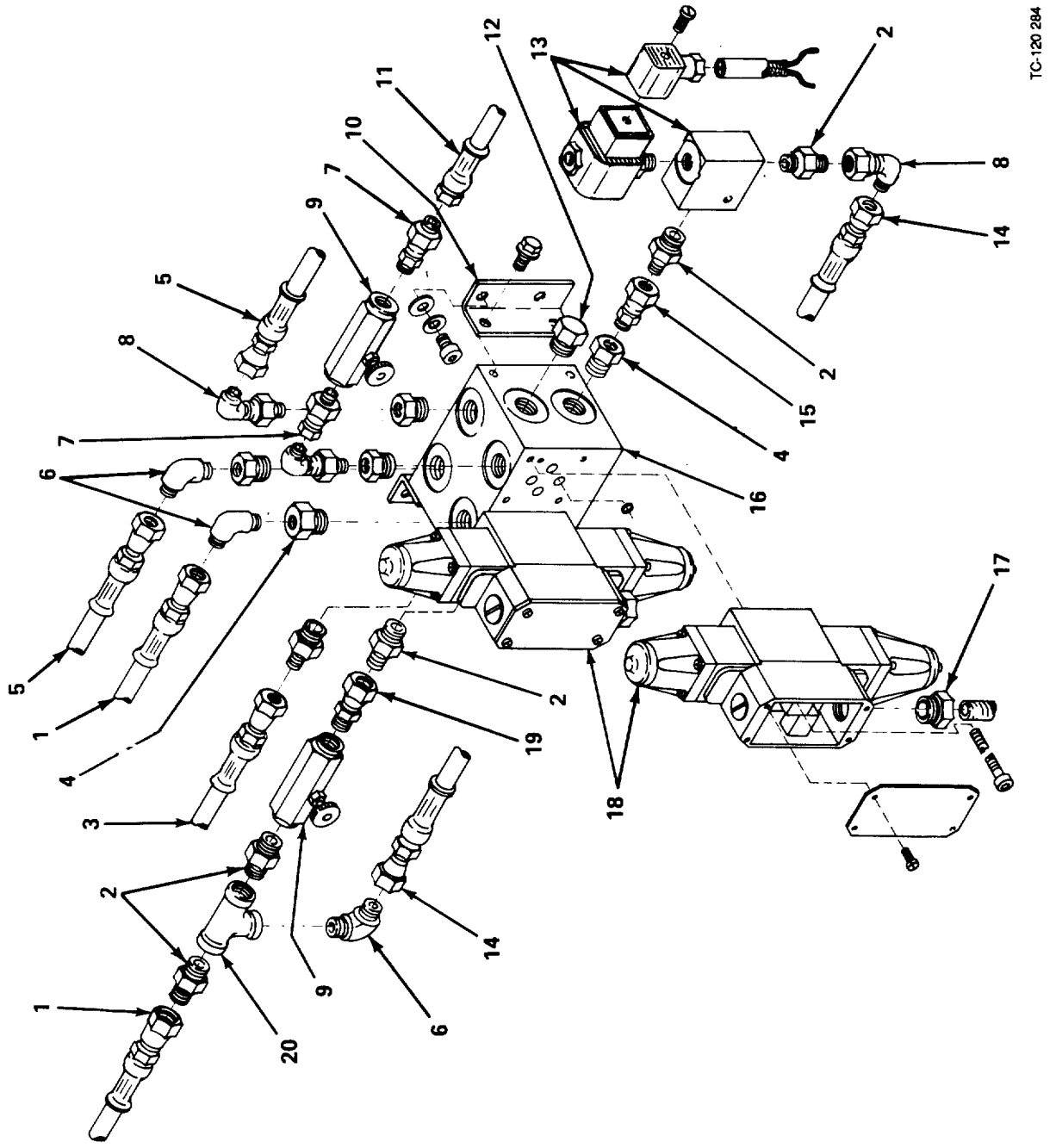

Figure C - Hydraulic Control Assembly

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure C			**Hydraulic Control Assembly (Fig A Pg 2 Item 31)**	
1		122 563	HOSE HYDRAULIC	2
2		122 566	FITTING HOSE	6
3		122 560	HOSE HYDRAULIC	1
4		122 550	FITTING HOSE	5
5		122 564	HOSE HYDRAULIC	2
6		122 544	FITTING HOSE	3
7		122 546	FITTING HOSE	1
8		122 547	FITTING HOSE	3
9		122 069	FLOW CONTROL VALVE	2
10		122 162	MANIFOLD MTG BRACKET	2
11		122 565	HOSE HYDRAULIC	1
12		122 551	FITTING HOSE	1
13	L5	122 082	HIGH SPEED SOLENOID	1
14		122 561	HOSE HYDRAULIC	2
15		122 548	FITTING HOSE	1
16		122 081	MANIFOLD	1
17		122 558	FITTING HOSE	1
18	L1-4	117 194	SOLENOID VALVE	2
19		122 552	FITTING HOSE	1
20		122 542	FITTING HOSE	1

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure D			**Drive Assembly (Fig D Pg 2 Item 39)**	
1		117 192	TIMING BELT	1
2		122 084	PULLEY	1
3		122 156	DRIVEN PULLEY	1
4		122 157	TAPERED BUSHING	1
5		122 158	SHAFT KEY	1
6		122 159	SHAFT SPACER	1
7		122 160	LOCK NUT	1
8		122 155	GROUNDING SHOE ASSEMBLY (consisting of)	1
9		123 223	· GROUND PAD	1
10		122 154	PROXIMITY SWITCH FLAGS	1
11		122 093	LOWER BEARING	1
12		122 092	BEARING ALIGNMENT PLATE	1
13		122 086	MTG PLATE ASSEMBLY	1
14		122 085	ROTARY ACTUATOR, 180 DEGREE	1
15		123 224	SHAFT KEY, ROTARY ACTUATOR	1
16		122 091	BRONZE WASHER	1
17		122 083	TAPERED BUSHING	1

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

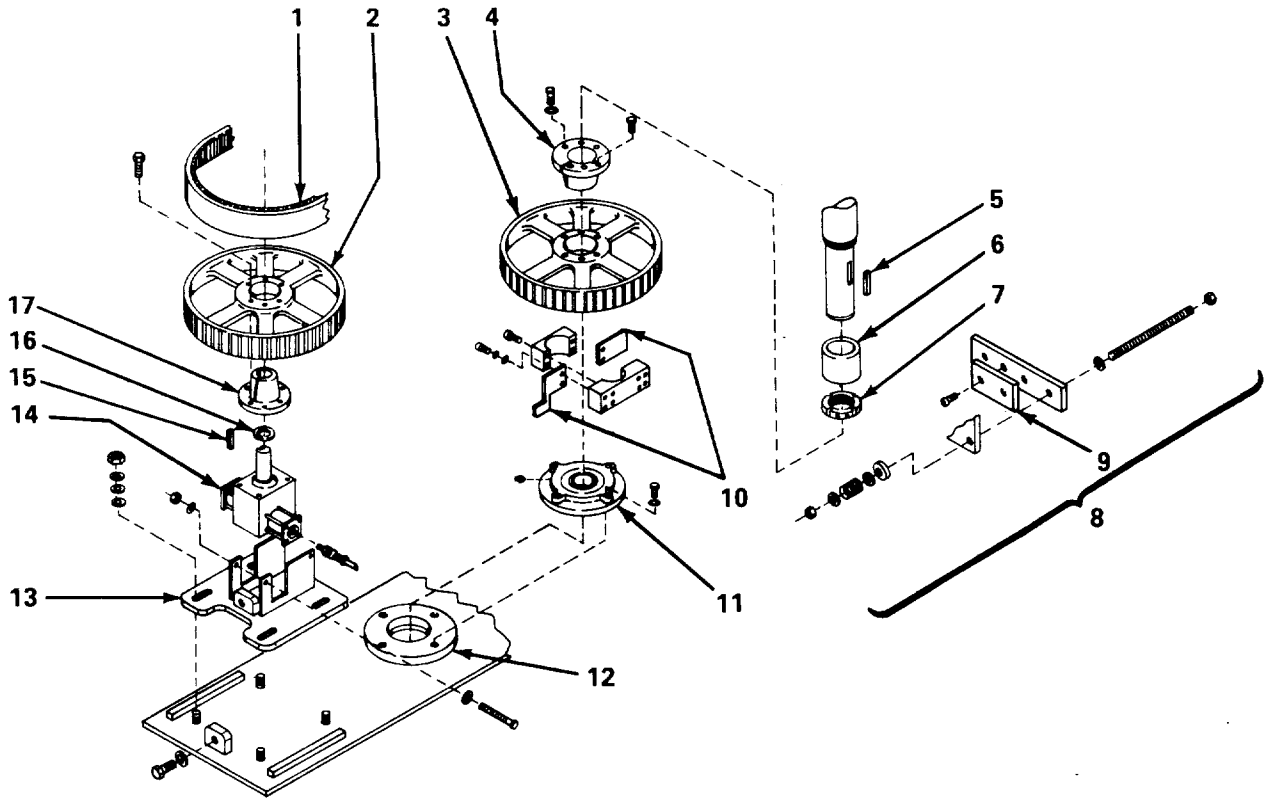

Figure D - Drive Assembly

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Item No.	Dia. Mkgs.	Part No.	Description	Quantity
Figure E			**Shock Absorber Assembly (Fig A Pg 2 Item 14)**	
1		122 077	SHOCK MTG NUT, LARGE	1
2		122 078	HYDRAULIC SHOCK ABSORBER	1
3		122 076	SHOCK MTG NUT, SMALL	1
4		122 079	SHOCK MTG PLATE	1
5		122 080	SHOCK ASSEMBLY MTG PLATE	1

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

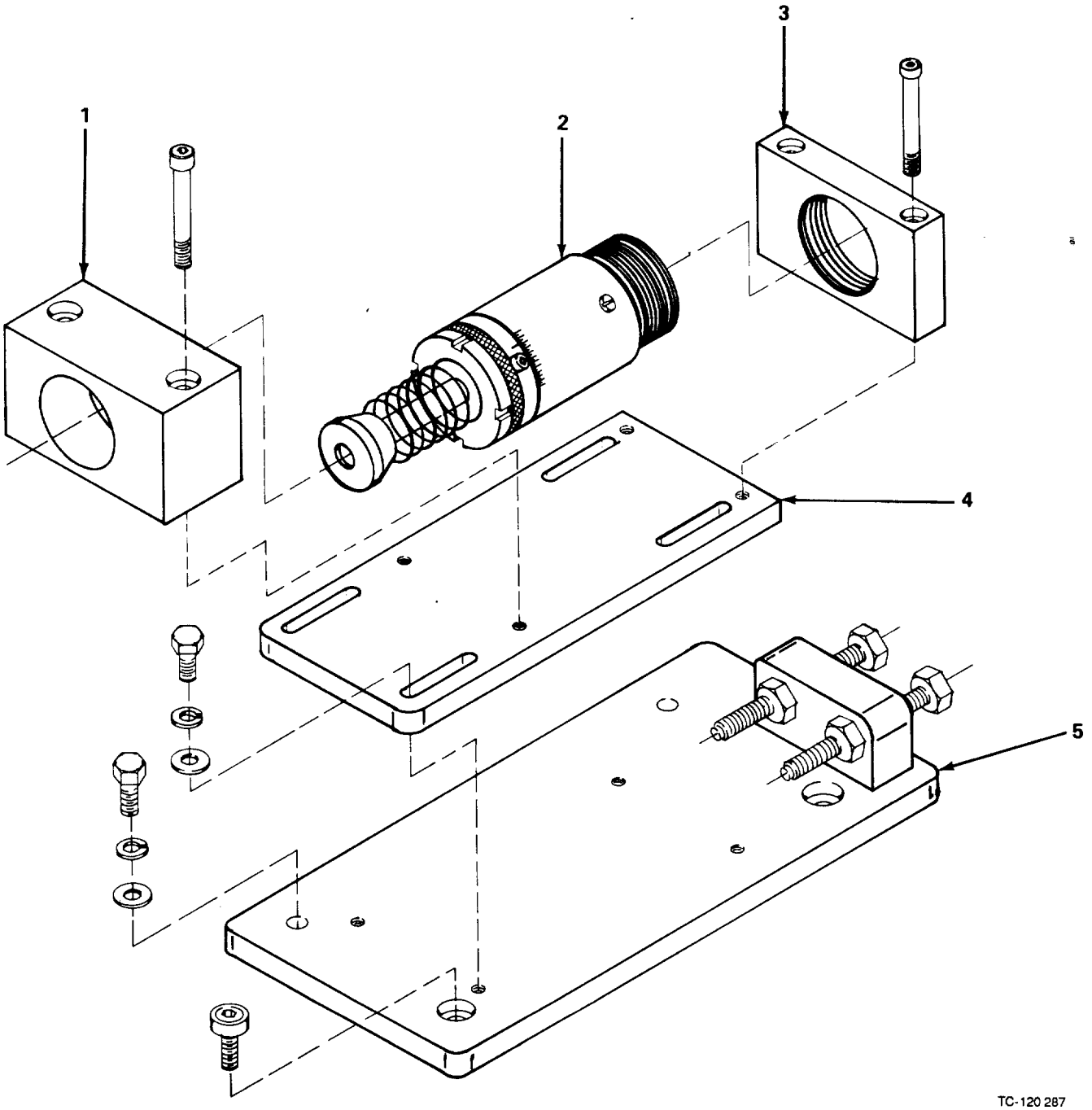

Figure E - Shock Absorber Assembly